United States Court of Appeals

for the Second Circuit

JOINT APPENDIX

76-4044

United States Court of Appeals
FOR THE SECOND CIRCUIT

No. 76-4044

BOC INTERNATIONAL LIMITED, f/k/a The British Oxygen Company Limited, BOC FINANCIAL CORPORATION, BOC HOLDINGS, LIMITED, and BRITISH OXYGEN INVESTMENTS, LIMITED,

Petitioners,

—against—

FEDERAL TRADE COMMISSION,

Respondent.

No. 76-4045

AIRCO, INC.,

Petitioner,

—against—

FEDERAL TRADE COMMISSION,

Respondent.

ON PETITIONS FOR REVIEW OF AN ORDER
OF THE FEDERAL TRADE COMMISSION

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PAGES A3585 TO A4180
EXHIBITS

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BOC RX 200	Document consulted by Dr. Hedley-Whyte during direct examination	A5218
BOC RX 206	June 1, 1970 Report on visit to Carpenter Technology by Perham and Muller	A5219
BOC RX 208	U.S. Dept. of Commerce, *U.S. Industrial Outlook*, 1974	A5222
BOC RX 222	Sept. 29, 1972, R. C. Hesketh-Jones, Consultation BOC-Overseas Companies	A5224
BOC RX 223	July 21, 1972, R. C. Hesketh-Jones, Overseas Company Boards	A5227

		PAGE
BOC RX 228	Program for the American Society of Anesthesiologists Annual Meeting, Oct.7-11, 1973	A5231
BOC RX 234	May 19, 1970 Letter from D. R. Harris to J. A. Perham	A5249
BOC RX 243	Percent Return on Total Invested Capital	A5250
BOC RX 244	Percent Return on Stockholders' Equity	A5251
BOC RX 246	Graphs of gas volume, quantity and unit price	A5252
BOC RX 260	Perry paper on oxygen and nitrogen (not in evidence)	A5265
BOC RX 261	American Iron & Steel Institute 1973 Report (not in evidence)	A5271

Exhibit Offered by Respondent Airco, Inc.

RAX 7	Airco Annual Report for 1973	A5274

Volume 10—In Camera Filings*

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* The Table of Contents for Volume 10 appears only in that volume.

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THE BRITISH OXYGEN COMPANY LIMITED

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Directors' Report & Accounts 1966

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overleaf Summary of Group Results
Sales by Markets
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◀ **Front Cover**

Gas flow through an Argonarc torch photographed by Schlieren technique

BEST COPY AVAILABLE

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THE BRITISH OXYGEN COMPANY LIMITED

Summary of Group Results

	1966 £'000	1965 £'000
Group profit before tax	10,050	11,875
Taxation	4,142	4,054
Dividends to BOC Shareholders	(Gross) 4,214	(Net) 2,725
Profit retained	571	3,895
Expenditure on Fixed Assets (*before Government Grant on UK expenditure*)	19,438	15,252

Distribution of Sales by Markets

	%
United Kingdom	50·7
Australasia	18·1
South Africa and Rhodesia	11·8
India and Far East	10·3
Europe and Middle East	3·7
Rest of the World	5·4
	100·0%

Shareholders' and Stockholders' Calendar

Dividend and Interest payments
Ordinary shares: Interim announced JUNE paid SEPTEMBER
Final proposed DECEMBER paid MARCH
Preference stocks: Paid half yearly, 30 June, 31 December
5½% & 6¾% Debenture stocks: Paid half yearly, 15 May, 15 November
8½% Tonnage Debenture stock: Paid half yearly, 15 June, 15 December

Announcement of Group Results
December quarter results—March
Half year results—June
Nine months' results—September
Year's results—December
Report and Accounts—January

Capital Gains Tax

For capital gains tax purposes the market value of BOC Ordinary shares, Preference stocks and Loan stocks at 6 April 1965 were:—

Ordinary shares of 5/- each	9/-¾d
6½% cum pref stock £1 units	19/9d
5% cum 2nd pref stock £1 units	14/6d
4% cum 2nd pref stock £1 units	11/3d
5¾% Debenture stock 1981/86	£87
6¾% Debenture stock 1985/90 fully paid	£99½
6¾% Debenture stock 1985/90 £50 paid	£51½

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THE BRITISH OXYGEN COMPANY LIMITED

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DIRECTORS AND EXECUTIVE MANAGEMENT

Board of Directors

J S HUTCHISON *Chairman*

Sir GEOFFREY C R ELEY CBE *Vice-Chairman*

Dr N GROSS, L E SMITH } *Joint Managing Directors*

Sir DUNCAN L ANDERSON KBE TD

P S BEALE

Sir JOHN G COWLEY KBE CB AM

JOHN L HARDIE

Sir OWEN WANSBROUGH-JONES KBE CB

Executive Management

Dr N Gross, L E Smith } *Joint Managing Directors*

A Eden-Green	*Public Relations*
R J Foster DFC AFC	*Overseas*
R C Hesketh-Jones	*Equipment*
P Laister	*Gases and Chemical Plant*
C A B Leslie	*Company Secretary*
P S Rowlands	*Finance*
J H Walwyn CB OBE	*Personnel*
J M Williams	*Chemicals*

Auditors

Cooper Brothers & Co *Chartered Accountants*

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THE BRITISH OXYGEN COMPANY LIMITED

NOTICE OF MEETING

Notice is hereby given that the eighty-first Annual General Meeting of The British Oxygen Company Limited will be held at Grosvenor House (Ballroom), Park Lane, London W1, on Tuesday 21st February 1967 at 12 noon.

1 To receive and consider the statement of accounts and the reports of the Directors and Auditors thereon.

2 To declare a dividend.

3 To elect Directors.

4 To fix the remuneration of the Auditors.

5 To transact any other business that may be transacted at an Annual General Meeting.

Only holders of ordinary shares are entitled to attend or be represented at the meeting. A member entitled to attend and vote may appoint one or more proxies to attend and vote instead of him. A proxy need not be a member.

By order of the Board
C A B Leslie
Secretary

Registered Office:
Hammersmith House
London W6
27th January 1967

Note: Warrants will be posted on 6th March if the proposed dividend is approved.

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REPORT OF THE DIRECTORS

THE DIRECTORS submit their report and statement of accounts for year ended 30th September 1966. The consolidated profit and loss account is summarised thus:

		£
Group profit after tax attributable to parent Company was		4,784,972
Subsidiary companies retained		1,008,041
		3,776,931
Profit brought forward	2,157,812	
Less adjustment of 1965 corporation tax to 40%	201,000	
		1,956,812
Available for distribution		5,733,743
These dividends have already been paid:		
Preference (less income tax retained)	109,857	
Ordinary interim of 3% (gross)	1,231,334	
		1,341,191
Leaving		4,392,552
Directors recommend:		
Transfer to debenture redemption reserve	118,057	
Final ordinary dividend of 7% (gross)	2,873,112	
		2,991,169
Carried forward		£1,401,383

Some gradual reduction in demand for main products during the year was offset by improving experience with others; there were many features of interest.

GASES DIVISION

Sales of oxygen and acetylene for general engineering purposes were up to expectation in the early months of the year but later fell a little below last year's figures. The reduction in volume sold was more than made good however by increased demand for nitrogen, argon and propane, sales of which have doubled in the last three years.

The obsolescence reserve of £1½ million, set aside last year, and £1 million now released from tax equalisation reserve, have been applied in writing-off the remaining book values of small capacity production plants which are no longer economic, as

Continued overleaf

explained in the Chairman's statement last year. Profits of the next few years will be relieved of the depreciation charge for the plants now written off.

Nitrogen

Many new uses for nitrogen derive either from its property of inertness, or from its extreme cold in the liquid phase. As gas, nitrogen is used increasingly and in large quantities for providing a non-reactive atmosphere in industrial processes such as for purging unwanted oxygen or other gases from pipelines, chemical plant, generators and tankers and is in general use as a blanket safeguard against fire. The extreme cold of liquid nitrogen on the other hand brings such widely divergent uses as shrink-fitting of heavy machinery parts, the conditioning of high alloy steels, the simulation of conditions of very low atmospheric temperatures in testing the Concorde airliner and soil freezing to facilitate tunnelling operations.

Both the inertness of gaseous nitrogen and the cold of liquid nitrogen are finding increasing use in the food industry. The quick freezing of food by liquid nitrogen has many advantages over other systems, while the Polarstream system for intransit refrigeration makes steady growth. Sparging by nitrogen gas is valuable to prevent the deterioration of liquid and semi-liquid foodstuffs such as oils, salad dressings, fruit juices, wines, etc.

The recent introduction of our Inert Nitrogen Protection service has aroused much interest and already the use of nitrogen in packing such foodstuffs as coffee, nuts, and cooled potato chips has demonstrated the effectiveness of INP in retaining the quality of foodstuffs. Similar interest is being shown in the first liquid nitrogen food freezer to be demonstrated in the UK which is installed at our development centre at Morden.

Our effort to develop these and many other outlets for nitrogen continues prominently, with strong technical backing from a team well skilled in these new processes.

Argon

The argon we can produce in quantity from our many tonnage air separation plants (although it forms no more than 1% of the earth's atmosphere) leaves us well placed to benefit from the ever-increasing demand for this 'rare' gas for its wide uses nowadays in specialised welding processes, in atomic energy installations and in the electronics and electrical industries.

Tonnage and pipeline oxygen

Tonnage sales, still less than 10% of group sales, were, as the year proceeded, affected by reduced demand from individual customers, but this was offset by the coming into operation of three new plants, making a total of twenty-nine BOC tonnage plants in the UK capable of producing 1.75 million tons of oxygen a year. There was also some benefit from the increased use made of plants originally expected to reach capacity working in earlier periods, but which were delayed to suit customer requirements.

Our oxygen pipeline in the Sheffield area now extends for seventeen miles and a similar system has just been commissioned in Lanarkshire. There have been additions also to our Teeside pipeline, and a fourth area is probably to be served in this way in the West Midlands. These pipeline systems make possible a more economical use of our production plants, while providing additional storage capacity. A more flexible and convenient service can thereby be offered to our customers.

The chemical plant works at Edmonton is engaged in the construction of two more tonnage plants at Scunthorpe and Motherwell which will be completed during 1967. These will be followed by a plant of 600 tons per day capacity for supplying ICI at Middlesbrough. It will be completed during 1968/69. Many other proposed uses for industrial gases in tonnage quantities are under consideration, and, although retarded to some extent by present

economic circumstances, are likely to become definite before long.

Medical Gases

We suffered a sharp upset through the very unfortunate and quite unprecedented incident in September when a small batch of contaminated gas was delivered in Southern Region. Prompt action was taken to minimise the danger and to recover the safety position which had been maintained without previous trouble for over 40 years and which, of course, is our first consideration in making gases for medical use. Supplies of specially tested gas were quickly restored and full steps have been taken to ensure safety for the future.

Our Entonox analgesic gas, first mentioned last year, has made a good start: it aroused great interest at the European Congress of Anaesthetists at Copenhagen and the World Midwives' Conference in Berlin. Negotiations are in progress for licensing Entonox in many parts of the world.

Gas mixtures

The growing demand for rare gases for laboratory and research purposes, and for special gas mixtures produced to a high degree of accuracy and purity, is now met by the separate special gases department established at our research and development centre at Morden. The first year's trading of the new department gave a 25% increase in sales and we expect considerable further growth.

EQUIPMENT DIVISION

Equipment Division had a successful year in its widely-based manufacture of user equipment, with a record turnover and profit, and good growth in exports. The first of our new Condor computer-controlled cutting machines—the most advanced of its kind in the world—has now been installed in a Sunderland shipyard. This machine cuts steel profiles up to 6 inches thick, 4 metres wide, and any length required, automatically and with the complete accuracy of numerical control, at a speed of over two feet a minute. Another introduction is the Falcon 2/3 metre cutting machine, which is the first to use a co-ordinate drive system designed and made in Great Britain. Flame planing machines of the same basic design as the Condor have found an early export sale in places as far apart as Australia and Finland.

Medical, anaesthetic and breathing equipment, produced by Equipment Division goes to 105 different countries. The increase of 35% in exports this year was particularly encouraging.

In electric welding materials improved production methods have enabled us to hold our place in extremely competitive conditions. Our comprehensive range of machines has been strengthened by the introduction of the Lynx IV which, with its rectified power source, is available for the new tubular electrode process which we expect to develop prominently.

In aviation equipment, our design of miniaturised equipment for regulation of the flow of oxygen to aircrews has aroused much interest and has been licensed in the United States and elsewhere abroad.

Cryoproducts department has made good progress in the manufacture and sale of such items as cryostats for liquid helium, and vivostats for storing and transporting biological specimens such as human cornea. This quickly-growing department is being given new scope by re-location in new factory premises.

We have recently contracted to build a helium refrigerator for the Central Electricity Research Laboratories which will operate to within a few degrees of absolute zero and will be used for large scale experiments in super-conductivity in connection with magneto-hydrodynamic generating systems. This refrigerator will make essential use of the BOC helium bearing turbine mentioned last year, which we are proud to have had selected by the

Continued overleaf

Ex-3-I

REPORT OF THE DIRECTORS *continued*

Ministry of Technology as one of the twelve outstanding examples of technological development to be exhibited at the British Trade Fair in Toronto.

Sparklets products continue their popular appeal particularly in export markets where sales are 40% of Sparklets total. The steady growth in sales has enabled us to plan the installation of advanced manufacturing plant which, when it is in full operation, should give considerable benefit.

CHEMICALS DIVISION

The carbide and acetylene works at Londonderry, Northern Ireland, has worked to full capacity, but will soon give way to the production of acetylene from naphtha in our new Wulff plant which will be the first of its kind in the world to operate on a commercial scale. The plant was completed on schedule and commissioning is proceeding. This plant has greater capacity than the one it supersedes, and the new process gives opportunity for expansion in new directions. An example of this is the arrangement recently made with Norsk Hydro for use at Londonderry of part of the ethylene by-product from the new plant along with Norsk Hydro chlorine to produce ethylene dichloride, which will then be exported to Norsk Hydro to use in their other manufactures. Plant will cost about £1 million and is due to come on stream in 1968.

The continuing manufacture of carbide and certain derivative chemicals at Odda in Norway, has been restricted a little by water shortage at the hydro-electric plant which is the source of the necessary power. Excellent progress has been made, however, with the £7 million expansion of the hydro-electric scheme in which we are associated and power from it is expected early in 1967.

The tall oil fractionation plant mentioned last year is now in production. This is a pioneering development for the UK and it has taken time to overcome a number of initial difficulties. It may be of interest that delivery of the rosin product from this plant is by a special vehicle at a temperature of 170°C. This is in direct contrast to other British Oxygen vehicles which often carry liquefied gases at about *minus* 190°C.

The costs of changing to new production methods, and of commissioning new plant, affected the profits of Chemicals Division. The basic trading position was little affected, however, and profits should recover when this special expense comes to an end and the expected new revenue begins.

OVERSEAS

Political troubles which were seemingly a threat in many places a year ago did not in the event affect earnings greatly. The hostilities between India and Pakistan inevitably brought some reduction in earnings in these countries, but a much greater change came from the subsequent devaluation of the Indian rupee. In Australia, earnings were reduced by the effects of the severe and prolonged drought and by financial restriction, but in South Africa and Canada profits improved notably. Earnings were well maintained in most other places, but we remain disappointed by our situation in Italy where there was little improvement.

DIRECTORS AND AUDITORS

The directors retiring by rotation are Mr J S Hutchison, Mr P S Beale and Sir John G Cowley: they will accept re-appointment.

The auditors, Cooper Brothers & Co, are willing to continue in office.

By order of the Board
C A B Leslie
Secretary

London
27th January 1967

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EX-3-J

REPORT OF THE AUDITORS

To the Members of The British Oxygen Company Limited

The balance sheet of the Company on pages 12 and 13 is in agreement with the books which, in our opinion, have been properly kept. We obtained the information and explanations we required. In our opinion the balance sheet, amplified by the information on pages 14 and 15, complies with the Companies Act 1948, and gives a true and fair view of the state of affairs of the Company.

The consolidated accounts on pages 8 to 11 incorporate figures of certain subsidiary companies which have not been audited by us. In our opinion, based upon our examination and the reports of other auditors, the consolidated accounts, amplified by the information on pages 14 and 15, comply with the Companies Act 1948, and give a true and fair view of the state of affairs and of the profit of the Group.

Cooper Brothers & Co.
Chartered Accountants

London
27th January 1967

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EX-7-K

THE BRITISH OXYGEN COMPANY LIMITED AND SUBSIDIARY COMPANIES

CONSOLIDATED PROFIT AND LOSS ACCOUNT

			1966		1965
			£		£
Trading profit					
United Kingdom			3,378,150		4,499,392
Overseas			6,671,744		7,375,105
			10,049,894		11,874,497
Taxation			4,142,244		4,053,509
Profit after taxation			5,907,650		7,820,988
Attributable to minority shareholders			1,122,678		1,201,117
			4,784,972		6,619,871
Small capacity plant written off		2,500,000			
Less obsolescence reserve		1,500,000			
tax equalisation released		1,000,000	—		—
Profit of parent Company brought forward		2,157,812			
Less adjustment of 1965 corporation tax to 40%		201,000	1,956,812		1,780,128
Transfer from tax equalisation reserve			—		1,000,000
Available for disposal			£6,741,784		£9,399,999
Dividends:					
Preference		122,500		122,500	
Ordinary: interim 3%		1,231,334		1,231,334	
proposed final 7%		2,873,112		3,283,557	
		4,226,946		4,637,391	
Less income tax retained		12,643	4,214,303	1,912,214	2,725,177
Retained:					
Parent Company:					
General reserve		—		1,500,000	
Obsolescence reserve		—		1,500,000	
Debenture redemption reserve		118,057		111,638	
Unappropriated profit		1,401,383		2,157,812	
Subsidiary companies		1,008,041	2,527,481	1,405,372	6,674,822
			£6,741,784		£9,399,999

Ex-3-L

NOTES

		1966	1965
		£	£
1	*Trading profit shown is after charging:*		
	Depreciation—United Kingdom	5,461,779	5,163,578
	Overseas	2,943,477	2,827,501
		8,405,256	7,991,079
	Pension and provident funds contributions	1,171,714	989,335
	Debenture and loan interest	1,217,813	866,674
	Bank overdraft interest	751,144	539,464
	Audit fees (parent Company £18,825)	67,138	65,891
	Emoluments of directors of parent Company:		
	as directors	8,162	10,650
	for management	90,334	76,188
	Payments to past directors and dependants of past directors of parent Company	38,858	19,546
		£11,750,419	£10,558,827
	and after crediting:		
	Trade investment income	£88,187	£110,097
2	*Taxation on profit of year:*		
	United Kingdom—corporation tax at 40% (1965 35%)	2,206,652	2,101,600
	income tax	(CR) 68,565	59,988
	profits tax	9,100	59,500
	tax equalisation	557,700	429,100
		2,704,887	2,650,188
	Reduced by—investment allowances	433,000	955,600
	double taxation relief	1,064,000	874,500
	provisions of prior years no longer required	220,000	250,000
		987,887	570,088
	Overseas—taxes	3,060,262	3,281,187
	tax equalisation	94,095	202,234
		£4,142,244	£4,053,509

3 *The unappropriated profits of overseas subsidiary companies are liable to overseas and United Kingdom taxation if distributed as dividends.*

4 *Profits of the next few years will be relieved of the depreciation charge for small capacity plant now rendered uneconomic and written off.*

THE BRITISH OXYGEN COMPANY LIMITED AND SUBSIDIARY COMPANIES

CX-3-M

CONSOLIDATED BALANCE SHEET 30th SEPTEMBER 1966

			1966 £	1965 £
Issued share capital of The British Oxygen Company Limited			43,544,464	43,544,464
Reserves				
Capital:				
Debenture redemption		529,491		411,434
Other		3,321,522		3,820,169
		3,851,013		4,231,603
Revenue:				
Reserves and unappropriated profits:				
The British Oxygen Company Limited	12,401,383			14,657,812
Subsidiary companies	5,930,159			5,187,281
		18,331,542		
			22,182,555	24,076,696
Total capital and reserves			65,727,019	67,621,160
Interests of minority shareholders			10,239,596	9,968,922
Tax equalisation			4,482,158	4,724,363
Secured Loans				
5¼% Debenture Stock 1981/86		9,429,154		9,555,866
6¼% Debenture Stock 1985/90		7,000,000		7,000,000
8½% Tonnage Debenture Stock 1988 (£6,000,000 part paid)		1,268,900		—
7% Debenture Stock 1971		263,745		—
7½% Debenture Stock 1976		467,012		—
7½% Debenture Stock 1981		2,854,900		—
Debenture and Mortgage Loans		2,067,084		1,457,762
			23,349,895	18,013,628
Current liabilities and provisions				
Bank overdrafts (secured £493,520)		12,782,832		9,107,654
Creditors and accrued liabilities		13,778,322		12,564,595
Taxation—United Kingdom		2,476,409		2,033,862
Overseas		3,163,921		3,519,999
Proposed final ordinary dividend	(*Gross*)	2,873,112		(*Net*) 1,929,090
			35,074,596	29,155,200
			£138,873,264	£129,483,273

THE BRITISH OXYGEN COMPANY LIMITED AND SUBSIDIARY COMPANIES

EX-3-N

CONSOLIDATED BALANCE SHEET 30th SEPTEMBER 1966

	Cost or valuation	Depreciation	1966	1965
	£	£	£	£
Fixed assets				
Freehold and leasehold properties	28,826,427	6,938,478	21,887,949	20,799,003
Plant and machinery	79,762,408	37,508,550	42,253,858	40,524,047
Cylinders	33,743,805	17,797,777	15,946,028	14,174,506
Motor vehicles	7,553,461	3,269,356	4,284,105	3,269,889
Furniture and fixtures	3,502,476	2,165,307	1,337,169	1,376,380
	£153,388,577	£67,679,468	85,709,109	80,143,825
Trade investments				
Shares at cost		2,195,008		2,175,063
Less amounts written off		669,665		720,759
		1,525,343		1,454,304
Amounts owing		1,290,488		945,390
			2,815,831	2,399,694
Current assets				
Stock and work in progress		24,551,924		23,604,204
Debtors and payments in advance		22,039,860		20,915,318
Investment grants receivable		1,739,972		—
Tax reserve certificates		91,300		84,625
Treasury bills and deposits at short call		988,916		922,738
Cash and bank balances		936,352		1,412,869
			50,348,324	46,939,754
			£138,873,264	£129,483,273

J S Hutchison *Director*
Geoffrey Eley *Director*

This Balance Sheet should be read in conjunction with the notes on pages 14 and 15

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BALANCE SHEET 30th SEPTEMBER 1966

		1966 Authorised £	1966 Issued £	1965 £
Capital				
6½% Cumulative Preference Stock		500,000	500,000	500,000
5% Cumulative Second Preference Stock		1,000,000	1,000,000	1,000,000
4% Cumulative Second Preference Stock		1,000,000	1,000,000	1,000,000
Ordinary shares of 5s.		41,044,464	41,044,464	41,044,464
Shares of 5s.		11,455,536	—	—
		£55,000,000	43,544,464	43,544,464
Reserves				
Capital:				
Debenture redemption		529,491		411,434
Other		1,159,696		982,684
		1,689,187		1,394,118
Revenue:				
General	11,000,000			11,000,000
Obsolescence	—			1,500,000
Unappropriated profit	1,401,383			2,157,812
		12,401,383		
			14,090,570	16,051,930
Total capital and reserves			57,635,034	59,596,394
Tax equalisation			4,125,000	4,459,000
Secured Loans				
5½% Debenture Stock 1981/86		9,429,154		9,555,866
6¾% Debenture Stock 1985/90		7,000,000		7,000,000
8½% Tonnage Debenture Stock 1988 (£6,000,000 part paid)		1,268,000		—
			17,697,154	16,555,866
Current liabilities and provisions				
Bank overdrafts—unsecured		10,724,877		6,453,641
Creditors and accrued liabilities		6,866,301		5,548,475
Taxation—United Kingdom		2,239,735		1,828,067
Overseas		129,319		112,932
Proposed final ordinary dividend	(*Gross*)	2,873,112	(*Net*)	1,929,090
			22,833,344	15,872,205
			£102,290,532	£96,483,465

THE BRITISH OXYGEN COMPANY LIMITED

Ex-3-P

BALANCE SHEET 30th SEPTEMBER 1966

	Cost £	Depreciation £	1966 £	1965 £
Fixed assets				
Freehold and leasehold properties	15,046,364	3,614,153	11,432,211	10,724,928
Plant and machinery	53,033,725	25,281,315	27,752,410	28,983,671
Cylinders	16,015,139	8,974,521	7,040,618	6,151,230
Motor vehicles	5,175,682	2,021,399	3,154,283	2,269,965
Furniture and fixtures	1,976,727	1,217,545	759,182	787,903
	£91,247,637	£41,108,933	50,138,704	48,917,697
Subsidiary companies				
Shares at cost and scrip issues at par, *less* amounts written off		15,961,619		14,534,502
Amounts owing, including dividends since declared		10,019,987		10,317,781
		25,981,606		24,852,283
Less amounts owing to subsidiary companies, *less* dividends since declared		473,253		431,812
			25,508,353	24,420,471
Trade Investments				
Shares at cost		682,774		670,092
Less amounts written off		108,529		108,529
		574,245		561,563
Amounts owing		595,388		558,063
			1,169,633	1,119,626
Current assets				
Stock and work in progress		11,885,231		10,619,435
Debtors and payments in advance		12,149,029		11,340,853
Investment grants receivable		1,398,730		—
Cash and bank balances		40,852		65,383
			25,473,842	22,025,671
			£102,290,532	£96,483,465

J S Hutchison *Director*

Geoffrey Eley *Director*

This Balance Sheet should be read in conjunction with the notes on pages 14 and 15

Ex-3-9

NOTES

1 Movements in reserves during year	Parent Company £	Consolidated £
Capital		
Balance at 1st October 1965	982,684	3,820,169
Retained by subsidiary companies (part of £1,008,041)	—	30,370
Profits less losses on sales of fixed assets	101,891	192,185
Scrip issue by a subsidiary company and adjustment to goodwill on trade investments	156,094	—
Revaluation of certain fixed assets in India and Ceylon	—	499,074
Other adjustments	6,502	10,244
	1,247,171	4,552,042
deduct:		
Reduction due to devaluation of Indian currency	—	1,021,885
Discount on and expenses of issue of debentures	87,475	129,061
Goodwill on subsidiary companies	—	79,574
Balance at 30th September 1966	£1,159,696	£3,321,522
Revenue		
Subsidiary companies' reserves and unappropriated profits:		
Balance at 1st October 1965		5,187,281
Retained this year (part of £1,008,041)		977,671
		6,164,952
deduct:		
Reduction due to devaluation of Indian currency		225,565
Other adjustments		9,228
Balance at 30th September 1966		£5,930,159

2 Stock and work in progress is included at cost or net realisable value whichever is lower, and cost where appropriate includes a proportion of overhead expenses.

3 Assets and liabilities in currency have been converted at rates ruling at 30th September 1966.

4 There were projects for expenditure on capital account against which orders had been placed by the Group to the extent of £8,200,000 of which £4,700,000 related to parent Company.

5 The parent Company has contingent liabilities amounting to £1,263,881 in respect of bank guarantees on behalf of subsidiary and other companies.

6 A subsidiary company has a liability (which has not been provided) for the payment for goodwill the amount of which cannot be determined until 1968. The maximum amount is £440,000.

7 The unappropriated profits of overseas subsidiary companies are liable to overseas and United Kingdom taxation if distributed as dividends.

8 The Company is under obligation to contribute to the Trustees of The British Oxygen Company's Staff and Works Pension Funds, in respect of improved benefits to employees, £55,400 per annum until 31st March 1972. Three overseas subsidiary companies are under obligation to contribute to the trustees of their Pension Funds £45,435 per annum over periods varying from nine to nineteen years.

EX-3-R

NOTES

9 There are exchange control restrictions in certain overseas countries on the remittance of funds to the United Kingdom.

10 Group fixed assets

	Cost 1.10.65	Capital expenditure	Demolitions sales and transfers	Cost or valuation 30.9.66
	£000s	*£000s*	*£000s*	*£000s*
Freehold and leasehold properties	27,238	2,534	946	28,826
Plant and machinery	71,980	9,179	1,396	79,763
Cylinders	30,797	3,698	751	33,744
Motor vehicles	6,653	2,013	1,113	7,553
Furniture and fixtures	3,425	272	194	3,503
	140,093	17,696	4,400	153,389

Capital Expenditure is after deducting UK investment grants £1,742,065.

Demolitions sales and transfers include Indian currency devaluation £3,100,000 offset by revaluation of fixed assets in India and Ceylon £663,000.

	Depreciation 1.10.65	Provided during year	Demolitions sales and transfers	Depreciation 30.9.66
	£000s	*£000s*	*£000s*	*£000s*
Freehold and leasehold properties	6,439	748	249	6,938
Plant and machinery	31,456	7,214	1,161	37,509
Cylinders	16,622	1,807	631	17,798
Motor vehicles	3,383	854	968	3,269
Furniture and fixtures	2,049	282	165	2,166
	59,949	10,905	3,174	67,680

Depreciation provided during year includes £2,500,000 written off small capacity plant.

Demolitions sales and transfers include Indian currency devaluation £1,430,000 offset by revaluation of Ceylon depreciation reserve £138,000.

The value of leasehold land and buildings at 30.9.66 included above is:

		Cost *£000s*	Depreciation *£000s*
Long term—more than 50 years:	UK	3,850	763
	Overseas	1,382	388
Short term:	UK	1,661	413
	Overseas	824	206

11 Depreciation is calculated to write off the assets during their expected normal lives by equal annual instalments (the straight line method) at rates ranging from 2½% to 25% per annum, depending upon the type of asset.

THE BRITISH OXYGEN COMPANY LIMITED AND SUBSIDIARY COMPANIES

EX-3-S

COMPARISON OF RESULTS

	1957 £000s	1958 £000s	1959 £000s	1960 £000s
CONSOLIDATED PROFIT				
Trading profit before depreciation	9,182	11,319	12,927	14,263
less depreciation	3,218	4,095	4,340	4,747
Profit before taxation	5,964	7,224	8,587	9,516
less taxation	3,215	3,890	4,066	4,439
Net profit	2,749	3,334	4,521	5,077
Disposal of profit:				
Profit retained:				
Minority shareholders	152	255	359	360
Parent Company	1,389	1,825	2,203	2,681
Dividends:				
Minority shareholders	157	203	227	290
Parent Company shareholders	1,051	1,051	1,732	1,746
	2,749	3,334	4,521	5,077
CAPITAL EMPLOYED				
Fixed assets *less* depreciation	37,388	40,728	42,520	44,910
Trade investments	147	195	194	189
Current assets	23,423	23,690	28,095	30,225
	60,958	64,613	70,809	75,324
less current liabilities (excluding bank overdrafts)	9,964	10,476	13,008	14,063
	50,994	54,137	57,801	61,261
Represented by:				
Bank overdrafts	1,123	369	43	273
Loan capital	12,097	12,085	12,770	12,544
Future taxation	3,115	4,086	4,084	4,459
Interests of minority shareholders	2,377	3,404	3,774	4,168
Preference stockholders' capital	2,500	2,500	2,500	2,500
Ordinary shareholders' capital and reserves	29,782	31,693	34,630	37,317
	50,994	54,137	57,801	61,261
RETURN ON AVERAGE CAPITAL EMPLOYED (Based on profit before taxation and interest charges)	14·1%	15·1%	16·6%	17·3%
ISSUED ORDINARY SHARES	£17,047	£17,047	£17,047	£17,047
ORDINARY DIVIDEND RATES				
On nominal value (adjusted for scrip issues)	5%	6%	7%	8%
On capital employed	5·8%	6·7%	7·2%	7·6%
NUMBER OF EMPLOYEES				
United Kingdom	13,000	13,300	14,000	15,100
Overseas	8,300	9,400	9,900	10,600

THE BRITISH OXYGEN COMPANY LIMITED AND SUBSIDIARY COMPANIES

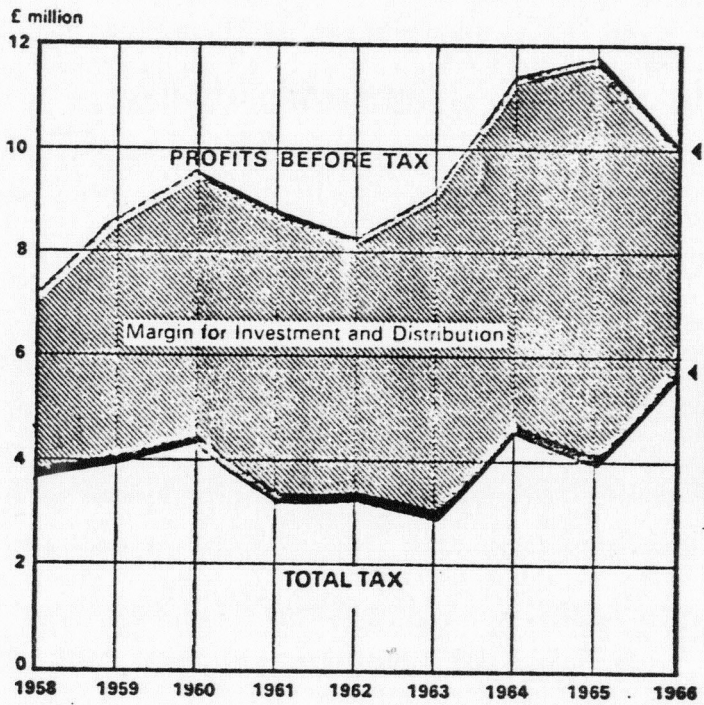
Ex-3-T

1961 £000s	1962 £000s	1963 £000s	1964 £000s	1965 £000s	1966* £000s
13,836	14,352	15,858	18,954	19,866	18,455
5,226	5,890	6,741	7,504	7,991	8,405
8,610	8,462	9,117	11,450	11,875	10,050
3,223	3,426	3,155	4,797	4,255	4,142
5,387	5,036	5,962	6,653	7,620	5,908
361	325	408	629	633	406
2,637	2,307	2,881	2,895	3,694	571
309	324	335	540	568	717
2,080	2,080	2,338	2,589	2,725	(*Gross*) 4,214
5,387	5,036	5,962	6,653	7,620	5,908
55,537	65,796	70,967	73,427	80,144	85,709
356	389	1,844	2,123	2,400	2,816
35,774	34,663	38,052	40,552	46,939	50,348
91,667	100,848	110,863	116,102	129,483	138,873
15,802	14,393	15,465	17,357	20,248	22,292
75,865	86,455	95,398	98,745	109,235	116,581
553	7,824	12,357	9,032	9,108	12,783
12,210	11,990	11,764	11,592	18,014	23,350
3,519	3,987	4,862	6,081	4,724	4,482
4,867	5,252	6,028	8,458	9,969	10,239
2,500	2,500	2,500	2,500	2,500	2,500
52,216	54,902	57,887	61,082	64,920	63,227
75,865	86,455	95,398	98,745	109,235	116,581
13·6%	11·5%	11·3%	13·0%	12·8%	10·6%
£30,683	£30,683	£30,783	£41,044	£41,044	£41,044
8%	8%	9%	10%	11%	10%
7·3%	6·1%	6·6%	6·9%	7·2%	6·4%
16,100	15,400	14,700	14,500	15,400	15,500
10,900	11,500	12,600	13,500	14,100	14,500

* In 1966 £2,500,000 was written off small capacity plant against which a similar amount was released from reserves.

Ex-3-U

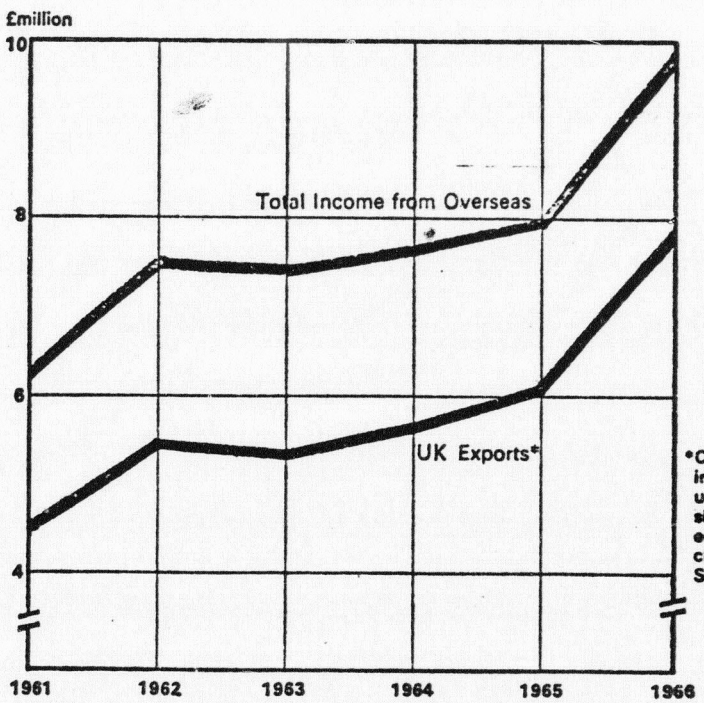
THE BRITISH OXYGEN COMPANY LIMITED AND SUBSIDIARY COMPANIES



GROUP PROFITS AND TAXATION

PROFITS BEFORE TAX

TOTAL TAX
For 1966 this includes Shareholders' Income Tax on dividends (1965 Finance Act)



UK INCOME FROM OVERSEAS

*Company's main products—industrial gases—are unexportable. Graph shows exports of equipment, chemicals, chemical plant and Sparklets

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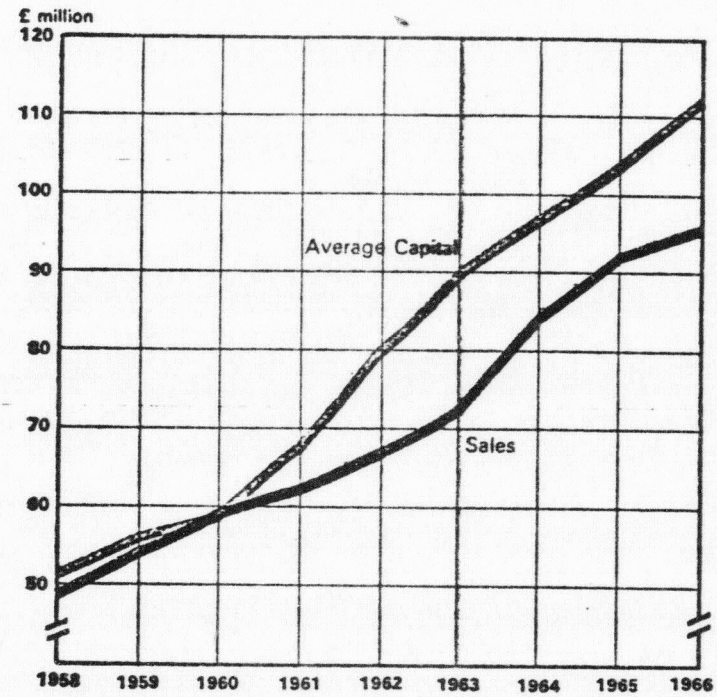
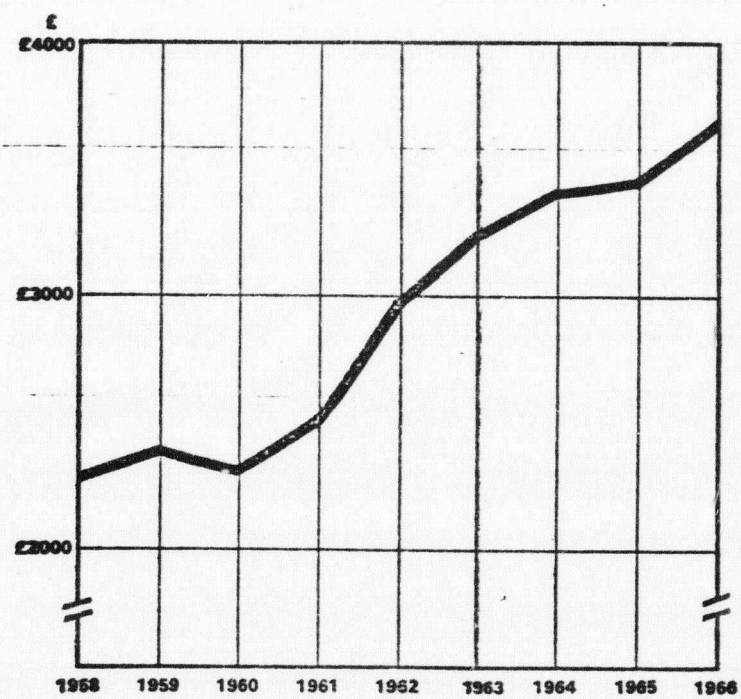
Ex-3-V

GROUP SALES AND AVERAGE CAPITAL EMPLOYED



GROUP AVERAGE CAPITAL EMPLOYED PER EMPLOYEE



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BOC PRINCIPAL GROUP COMPANIES

	BOC Percentage interest	
UK		**The British Oxygen Company Limited**
	100	**British Oxygen Chemicals Ltd.**
	100	**British Industrial Gases Ltd.**
AUSTRALIA	59	**The Commonwealth Industrial Gases Ltd.** Sydney Adelaide Brisbane Darwin Hobart Melbourne Mt. Isa Newcastle Perth Port Kembla Port Moresby Rockhampton Townsville Whyalla
BURMA	100	**Burma Oxygen Ltd.** Rangoon
CANADA	100	**Canadian Oxygen Ltd.** Toronto Montreal Ottawa Sherbrooke Vancouver
	33	**Canadian Helium Ltd.** Swift Current
CEYLON	100	**Ceylon Oxygen Ltd.** Colombo
EIRE	49	**Industrial Gases (IFS) Ltd.** Dublin
GERMANY	100	**BOC Deutschland G.m.b.H.** Solingen Gräfrath
HONG KONG	50	**Hong Kong Oxygen & Acetylene Company Ltd.**
	100	**British Oxygen (Hong Kong) Ltd.**
INDIA	66	**Indian Oxygen Ltd.** Calcutta Ahmedabad Amritsar Asansol Bangalore Bombay Delhi Gauhati Ghaziabad Hyderabad Jamshedpur Kanpur Madras Ranchi Tiruchirapalli Visakhapatnam
ITALY	50	**Rivoira S.p.A.** Turin Florence Milan Novara Rome
	100	**Saccab S.p.A.** Milan
	100	**Fusarc Italiana S.p.A.** Milan
KENYA	100	**East African Oxygen Ltd.** Nairobi Mombasa
MALAYSIA	100	**Malayan Oxygen Ltd.** Kuala Lumpur Ipoh
	100	**Malayan Welding Products Ltd.** Kuala Lumpur
NEW ZEALAND	63	**New Zealand Industrial Gases Ltd.** Wellington Auckland Christchurch Dunedin Napier
NIGERIA	50	**Industrial Gases Ltd.** Lagos Kano Warri
NORWAY	100	**Odda Smelteverk A/S**
PAKISTAN	60	**Pakistan Oxygen Ltd.** Karachi Chittagong Dacca Lahore Hyderabad Khulna Lyallpur Mangla Multan Nowshera Wah
RHODESIA	100	**Rhodesia Oxygen (PVT.) Ltd.** Bulawayo Gwelo Salisbury
SIERRA LEONE	50	**Sierra Leone Oxygen Factory Ltd.** Freetown
SINGAPORE	100	**Singapore Oxygen Ltd.**
SOUTH AFRICA	70	**African Oxygen Ltd.** Johannesburg Bloemfontein Cape Town Durban East London Germiston Klerksdorp Port Elizabeth Pretoria Vanderbijlpark Welkom Windhoek
SWEDEN	100	**Svenska BOC AB** Gothenburg
TANZANIA	100	**Tanzania Oxygen Ltd.** Dar-es-Salaam
UGANDA	100	**Uganda Oxygen Ltd.** Kampala
ZAMBIA	100	**Zambia Oxygen Ltd.** Ndola Lusaka

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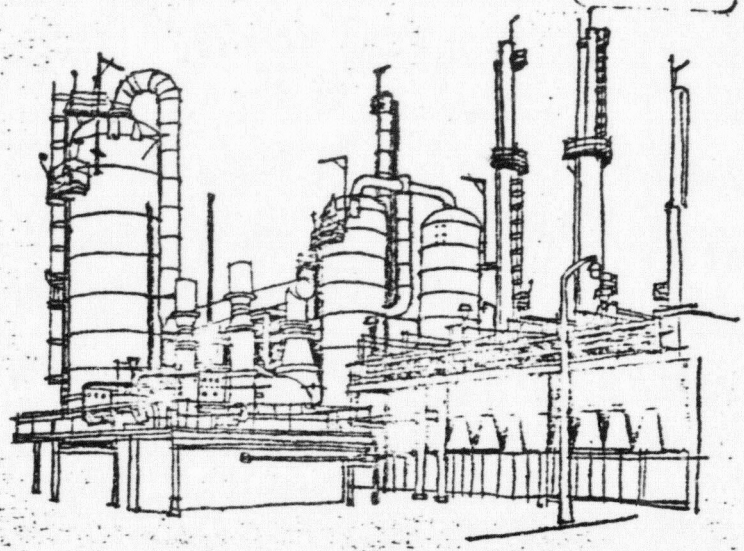
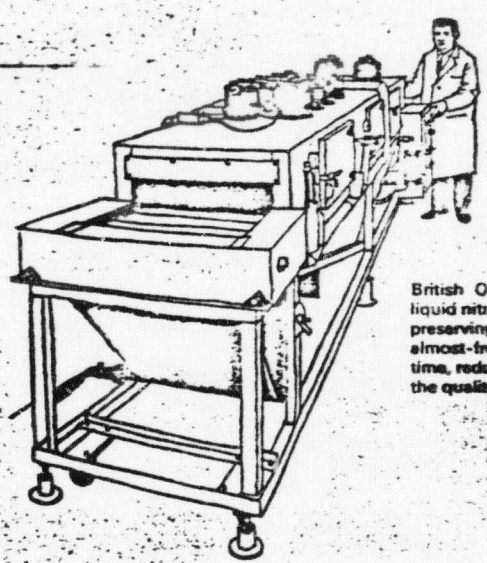
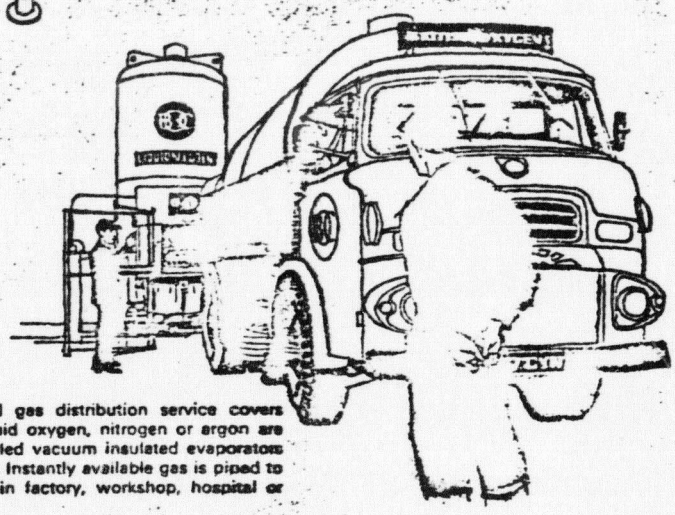
EX-3-X



Part of the new Wulff plant at Maydown, Londonderry, Northern Ireland, where British Oxygen Chemicals makes acetylene by the naphtha route. Commissioned within the last few months, it is the first of its kind in the world to operate on a commercial scale.



British Oxygen's quick-frozen food process, using BOC liquid nitrogen, is the only commercially available method of preserving strawberries and other hard-to-freeze foods in an almost-fresh state. The liquid nitrogen process cuts freezing time, reduces handling and overheads and greatly improves the quality and flavour of frozen foodstuffs.



BOC's bulk liquid and gas distribution service covers Britain. Supplies of liquid oxygen, nitrogen or argon are delivered to BOC-installed vacuum insulated evaporators on customers' premises. Instantly available gas is piped to wherever it is needed in factory, workshop, hospital or laboratory.

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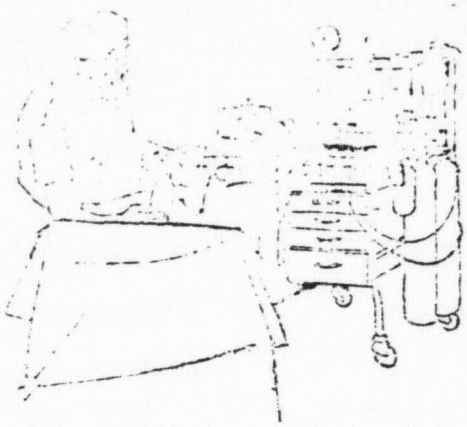
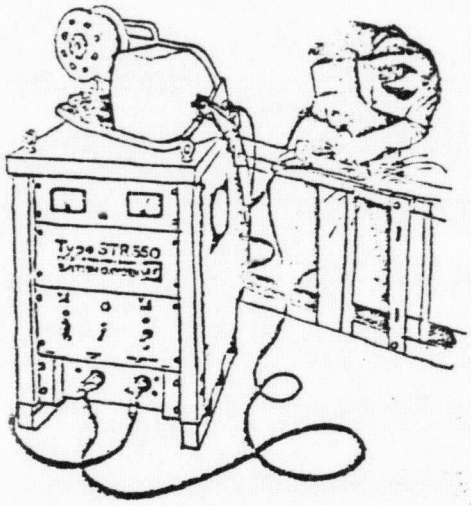
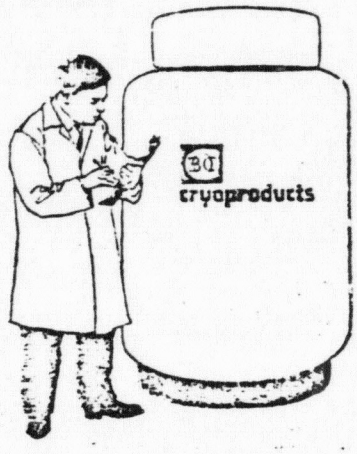
Cx 3-x-1



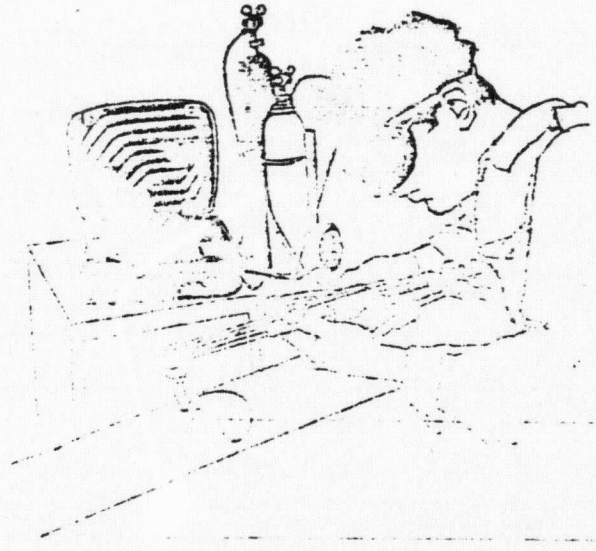
BOC's Boyle anaesthetic equipment is in use all over the world for the administration of a wide range of medical gases.

Liquid helium is the coldest substance known to man and is increasingly important to modern industrial development. This gas shielded liquid helium tank, produced by BOC's Cryoproducts department, will hold 1,000 litres.





Lynx IV is the latest, most powerful, addition to BOC's range of electric semi-automatic welding equipment for use in metal fabrication.



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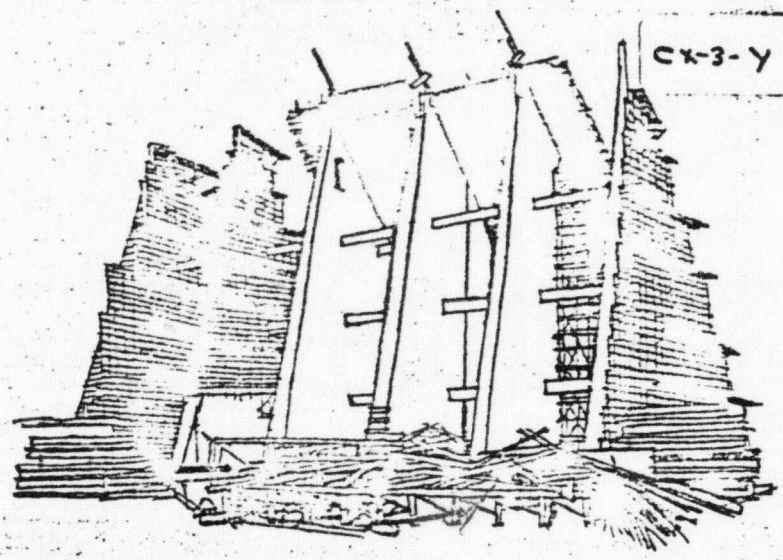
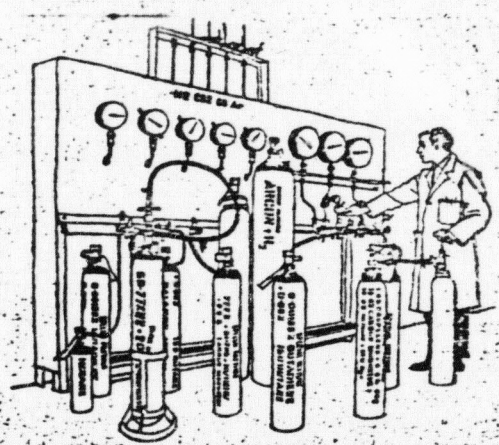
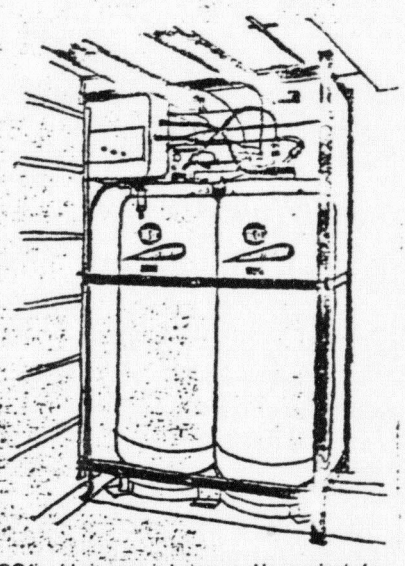


The dam under construction at Langevann above Tysse, Norway, is part of the £7m hydro-electric scheme in which BOC participates. Power is used by BOC's company at Odda for making calcium carbide and derivative chemicals.



Special Gases Department meets individual demands for rare gases, top-purity gases and special gas mixtures. An interesting example of the use of close tolerance mixtures stems from new legislation in the US covering the toxity of vehicle exhaust gases. Car manufacturers now require simulated mixtures as reference gases.



BOC liquid nitrogen is being used increasingly for maintaining cold 'rooms' at the required temperature. The system is known as Polarstream. Already it is used extensively for transporting meat, frozen foods and other perishables. BOC Polarstream units are easily installed where space is at a premium—particularly in vehicles. Few moving parts ensure reliability and long life.

Sparklets soda syphons and other Sparklets equipment are exported to 150 different countries.

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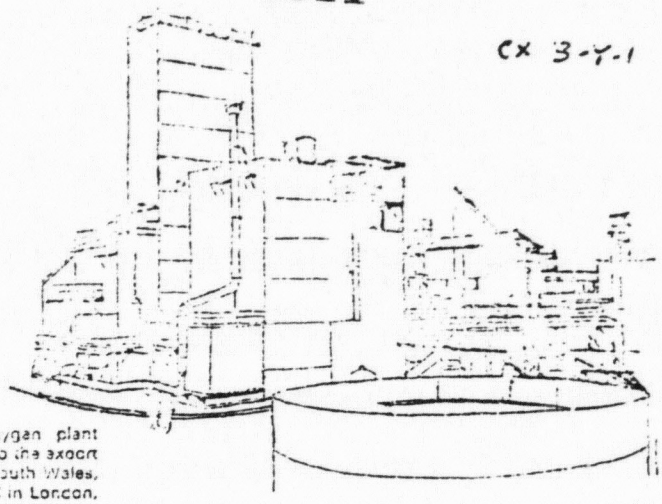
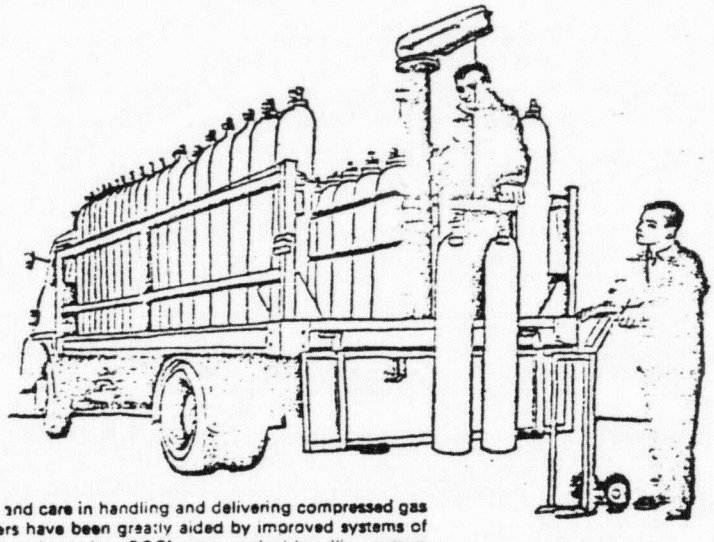
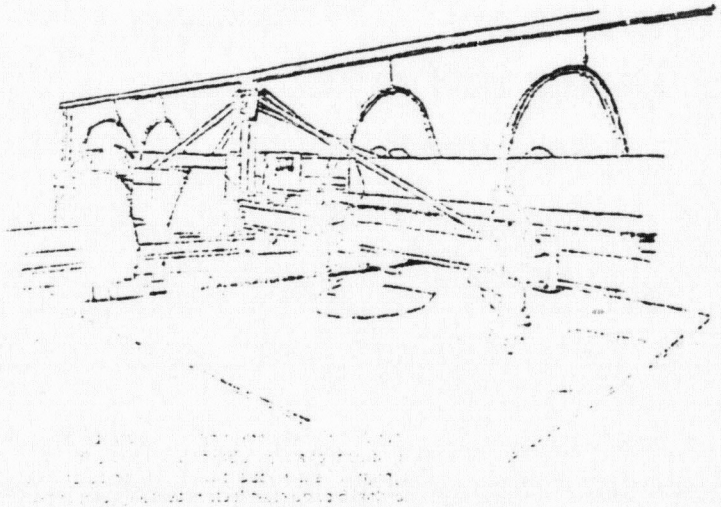


Manufacture of tonnage oxygen plant makes a healthy contribution to the export drive. At Port Kembla, New South Wales, Australia, a plant built by BOC in London, for making 565 tons of oxygen a day, is being installed for Australian Iron & Steal Pty. Ltd.



Speed and care in handling and delivering compressed gas cylinders have been greatly aided by improved systems of loading and carrying. BOC's new vertical handling system is also much safer for operatives.



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THE BRITISH OXYGEN COMPANY LIMITED

EX-3-2

I, ...

(PLEASE COMPLETE IN BLOCK LETTERS)

of, ...

being a member of the above named Company, hereby appoint JAMES SELLER HUTCHISON, or failing him SIR GEOFFREY ELEY, or failing him LESLIE EDWARD GEORGE SMITH, all of Hammersmith House, London, W.6, as my proxy to vote for me and on my behalf at the Annual General Meeting of the Company to be held at Grosvenor House (Ballroom), Park Lane, London, W.1, at 12 noon, on the 21st day of February, 1967, and at any adjournment thereof.

Signed ..... *Dated* 1967

NOTES (1) This proxy must reach the registered office of the Company by 19th February, 1967.
(2) A corporation's proxy must be under its Common Seal.
(3) A form to appoint a proxy other than those named above will be supplied on request.

SCP&C

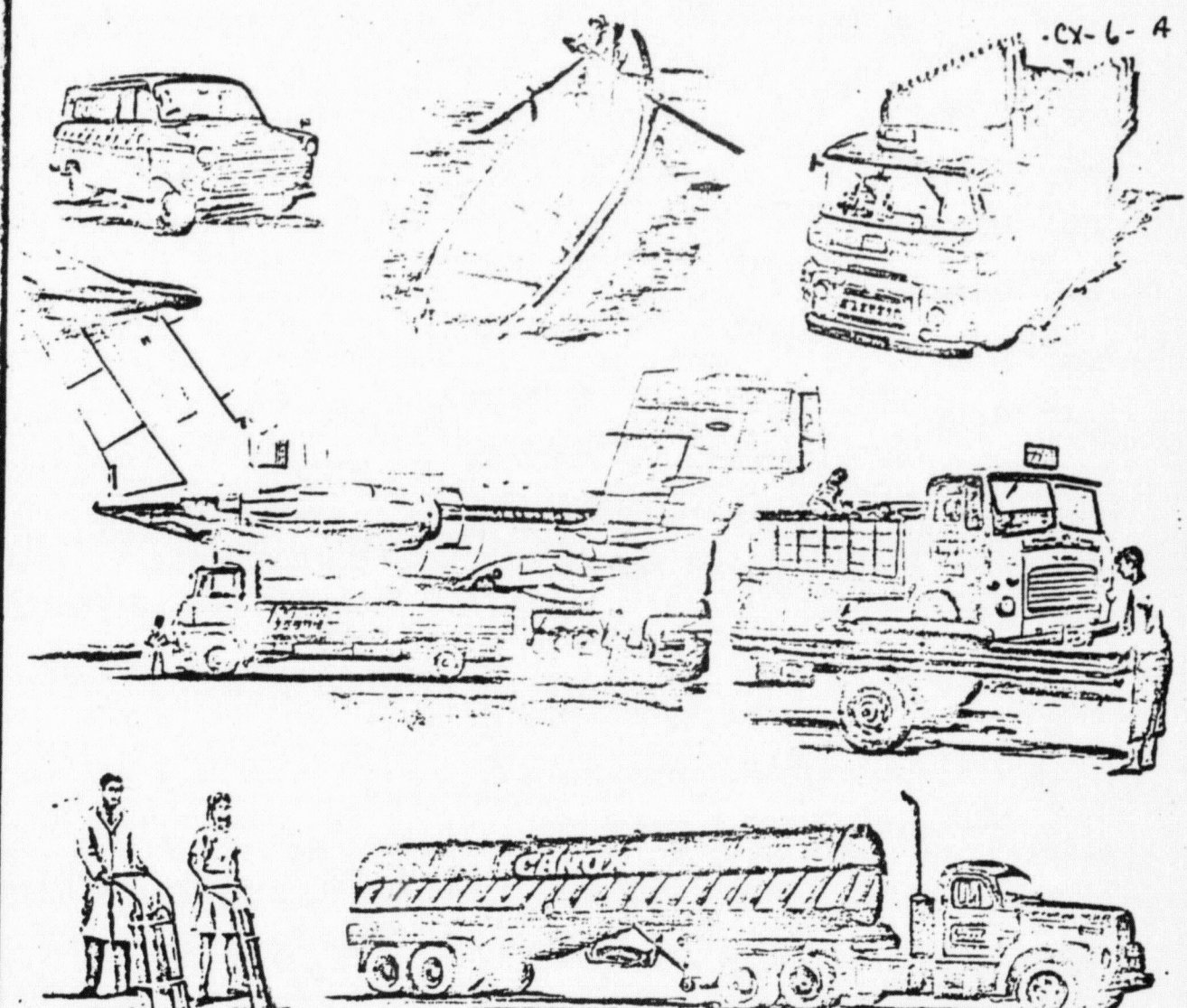
A3613

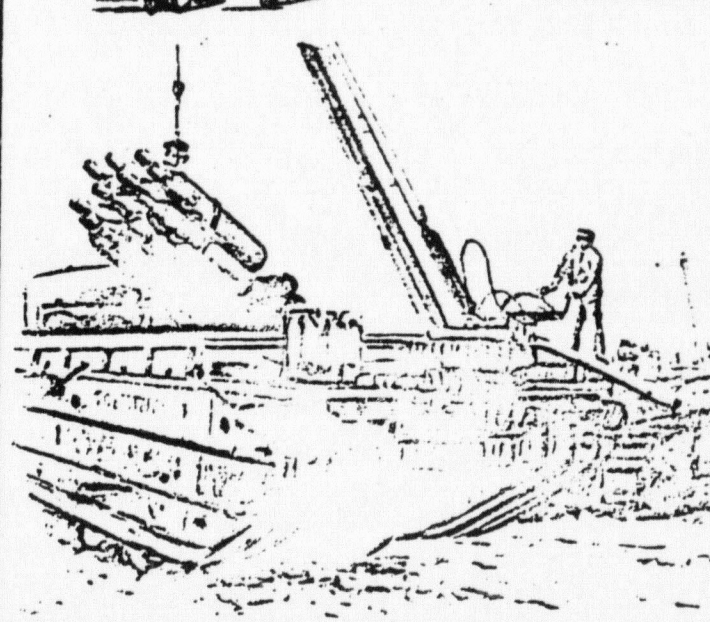
CX 3-2-1

St. Clements Fosh & Cross Limited

A 3614

CX-6-4





British Oxygen Report and Accounts 1968

A 3615

CX-6-B

THE BRITISH OXYGEN COMPANY LIMITED

Directors' Report & Accounts 1968

contents

overleaf	Summary of Group Results
	Sales by Markets
	Shareholders' and Stockholders' Calendar
	Capital Gains Tax
Page 1	Directors and Executive Management
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Pages 6-7	Chairman's Statement
Page 8	Report of the Auditors
Page 9	Consolidated Profit and Loss Account
Pages 10-11	Consolidated Balance Sheet
Pages 12-13	Parent Company Balance Sheet
Pages 14-15	Notes on Consolidated Profit and Loss Account
Pages 15-17	Notes on the Balance Sheets
Pages 18-19	Comparison of Results
Page 20	BOC Principal Group Companies
facing page 20	Form of Proxy

Cover Illustration

BOC companies operate specialised vehicles across five continents—sometimes supplemented by more unconventional modes of transport.

Front cover

BOC delivery van; cylinders collected by river in Pakistan; vertical cylinder handling lorry; African Oxygen supplying oxygen to VC10 aircraft; Indian Oxygen delivery lorry; trolleys for medical gas cylinders; 500,000 cubic foot Canadian Oxygen cryogenic transporter; CIG dry hydrogen being unloaded at Wilkes Station, Antarctica.

Back cover

Elephant power in Ceylon; camel with load of cylinders in Pakistan; Indian Oxygen cylinders on a bullock cart; African Oxygen delivers Handigas by scooter; cylinder on bicycle rickshaw in India; precarious load for an African cyclist; East African Oxygen hydrogen trailer; delivery of BOC cylinders to Longships lighthouse for thermic boring; BOC cryogenic tanker.

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Ex-6-C

THE BRITISH OXYGEN COMPANY LIMITED

Summary of Group Results

	1968 £000	1967 £000
Group profit before tax	13,272	10,160
Taxation	6,000	4,440
Exceptional profits less losses	287	1,556
Dividends to BOC Shareholders	4,549	4,226
Profit retained	1,374	1,801
Expenditure on Fixed Assets (*before Government grant on UK expenditure*)	17,328	17,432

Distribution of Sales by Markets

	%
United Kingdom	49.9
Australasia	17.2
South Africa	10.1
India, Pakistan and Far East	9.3
Europe and Middle East	5.9
Rest of the World	7.6
	100.0

Shareholders' and Stockholders' Calendar

Dividend and Interest Payments

Ordinary Shares	Interim announced June paid September. Final proposed December paid March.
Preference stocks	Paid half yearly, 30 June, 31 December
5¾% & 6¾% Debenture stocks	Paid half yearly, 15 May, 15 November
8½% Tonnage Debenture stocks	Paid half yearly, 15 June, 15 December
7½% Convertible Unsecured Loan stock	Paid half yearly, 15 July, 15 January

Conversion dates	*Number of Ordinary Shares of 5s. each for each £100 Stock converted.*
31st March 1970	215
31st March 1971	200
31st March 1972	185

Announcement of Group Results

December quarter results	—March
Half year results	—June
Nine months' results	—September
Year's results	—December
Report and Accounts	—February

Close Company Provisions

As far as is known the close company provisions of the Finance Act, 1965 do not apply to the Company.

Capital Gains Tax

For capital gains tax purposes the market value of BOC Ordinary shares, Preference stocks and Loan stocks at 6 April 1965 were:—

Ordinary shares of 5/- each	9/0¾d
6½% cum pref stock £1 units	19/9d
5% cum 2nd pref stock £1 units	14/6d
4% cum 2nd pref stock £1 units	11/3d
5¾% debenture stock 1981/86	£87
6¾% debenture stock 1985/90: fully paid	£99½
£50 paid	£51½

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CX-6-D

THE BRITISH OXYGEN COMPANY LIMITED

DIRECTORS AND EXECUTIVE MANAGEMENT

Board of Directors

J S HUTCHISON *Chairman*

Sir GEOFFREY C R ELEY CBE *Vice-Chairman*

Dr N GROSS, L E SMITH } *Joint Managing Directors*

Sir DUNCAN L ANDERSON KBE TD

P S BEALE

Sir JOHN G COWLEY KBE CB AM

JOHN L HARDIE

Sir OWEN WANSBROUGH-JONES KBE CB

Executive Management

Joint Managing Directors	Dr N Gross
	L E Smith
Chief Executives:	
Gases	P Laister
Welding Products	N F J Reckitt
Equipment	D W E Stafferton
Chemicals and Metallurgical	J M Williams
Overseas	R C Hesketh-Jones
Europe	L R Batten OBE
Finance	P S Rowlands
Personnel	J H Walwyn CB OBE
Public Relations and Marketing Services	A Eden-Green
Company Secretary	C A B Leslie

Auditors Cooper Brothers & Co *Chartered Accountants*

A 23618

CX-6-E

THE BRITISH OXYGEN COMPANY LIMITED

REPORT OF THE DIRECTORS

The Directors submit their report and statement of accounts for the year ended 30th September 1968.

The consolidated profit and loss account is summarised thus:

		£000
Trading profit after tax attributable to parent Company		5,636
Exceptional profits, less losses, after tax		287
Group profit available for distribution		5,923
Dividends already paid:		
Preference	122	
Ordinary interim of 3% on 171,085,742 5/- shares	1,283	
		1,405
Directors recommend:		
Final ordinary dividend of 7.35% on 171,085,742 5/- shares	3,144	
Profit retained	1,374	
		4,518
		5,923

The profits of Murex and Edwards High Vacuum since acquisition are included in the consolidated figures and were almost sufficient to cover the cost of servicing the funds involved in their acquisition.

The principal activities of the group are reported as follows:—

GASES DIVISION

The improved level of demand experienced towards the end of 1967 for oxygen and acetylene for general engineering purposes, was no more than maintained during the year. Nitrogen sales on the other hand again advanced rapidly, encouraged by an increased development and marketing effort on new uses in the food and cryogenics fields. Argon and helium continued to be in strong demand as were high purity gases and many gas mixtures to exact specifications supplied to universities and research laboratories and to a growing number of sophisticated industrial users.

Demand for tonnage oxygen for steelmaking increased moderately throughout the year and continues to grow. Fresh requirements include a major contract for oxygen which will call for another addition to our tonnage plant. Similar plant will be required also for the chemical industry to supply tonnage quantities of nitrogen to ICI at Runcorn.

Sales of gases for medical purposes continued to grow and our analgesic gas Entonox is increasingly used here and overseas. Our service in the provision of pipeline installations in hospitals continued to be fully engaged.

The manufacture of cryostats, vivostats and other appliances for handling cryogenic liquids outgrew the original location alongside our research establishment at Morden, and was transferred during the year to a modern factory in Jarrow. The inevitable difficulties brought about by such a change have been overcome and we look forward to the contribution this technically advanced activity will undoubtedly make.

We were successful last year in our action in the High Court claiming investment grants, previously disallowed by the Board of Trade, on our expenditure of over £1 million per annum on certain types of capital equipment. An appeal by the Board of Trade against this decision is likely to be heard at an early date.

WELDING PRODUCTS DIVISION

Gas and electric welding processes and the manufacture and marketing of advanced types of oxy-fuel gas cutting machines and associated equipment were affected by the general economic situation and turnover did not increase as we had hoped. Close attention to costs and improvements in operating efficiency, however, brought an appreciable gain in profits from this Division.

BOC and Murex resources in electric welding and in the development and manufacture of consumables and user equipment are being integrated on a single site at Waltham Cross where the combined research, manufacturing and production facilities will form one of the most comprehensive units of its kind in the world. The benefits from this integration will begin to be felt during 1969.

New products marketed this year included the gravity welding machine and the Gravimax iron powder electrode for high-quality, high-speed economy fillet welding: these have considerable appeal in the shipbuilding and engineering industries, permitting one operator to handle four or more machines at a reduced fatigue level with a labour cost reduction of up to 70%. Another introduction was the mini deck-welder which

REPORT OF THE DIRECTORS *continued*

can be moved from one job to another by a single operator and has a more comprehensive specification than any other welding machine on the world market at a comparable price: 60% of sales so far have been exports.

Electron beams, ion beams and lasers are a group of high energy sources having important application to welding, heating and cutting operations. They form a natural extension of our existing interests in conventional and plasma arcs, and relate directly to Edwards High Vacuum experience with electrons and ion beams. Work on the practical uses of lasers shows considerable promise, and the first prototype equipment for an industrial cutting application is nearing completion.

As was expected—and despite every effort—export benefit from devaluation in this Division was small, and it was encouraging therefore to get an order from Poland last month for a complete electrode manufacturing line to be installed next year.

EQUIPMENT DIVISION

The sale of Sparklets products continued to grow and our recent purchase of Heimsyphon GmbH, Germany, which manufactures and markets similar products on the Continent, will provide considerably enlarged scope.

Our medical equipment range has been strengthened by the introduction of the mini-Boyle, a compact version of the well-established Boyle anaesthetic table, and by the Wright respirometer which has had a particular success in the USA.

Exports by Equipment Division last year increased by 33%: we look for improvement again from further steps taken in support of this export success.

CHEMICALS AND METALLURGICAL DIVISION

On the chemicals side a number of planned extensions were completed during the year. At Odda Smelteverk, Norway, the output of carbide, which increased by 60% in 1967, rose last year by another 30% and the company achieved record results. Another satisfactory result came from the new production capacity for Tall Oil projected a year ago, which has been successfully commissioned and has given a 65% increase in output which was above expectation.

Unfortunately, difficulties with the Wulff acetylene plant at Londonderry—similar to those experienced by others seeking to commission the same kind of plant—persisted throughout the year and materially affected the outcome there. Available experience and knowledge has been exchanged with others facing the same problem and it is believed that plant adjustments now in hand should result in steady improvement during 1969.

Metallurgical activities at Murex, Rainham, fall into three sections. A determined sales effort in the highly competitive trade in alloying agents for the iron and steel and non-ferrous metal industries raised exports from £0.88 million to £2.27 million. Sales of tungsten carbide components, used mostly in cutting tools, were slightly down, but reorganised methods brought a material improvement in profits. The refractory metals—tungsten, molybdenum, tantalum, niobium, etc—also yielded increased profits from marginally reduced sales.

The directions of our next stage of advance have been established and plans are in hand to exploit effectively our metallurgical resources.

EXTENSION OF INTERESTS

Edwards High Vacuum International Ltd made rather better profits in the seven months to 30th September 1968 than were forecast at the time of its acquisition. Many opportunities for the development of EHV's specialised business are seen and benefit will also arise from alignment in suitable fields with other BOC activities.

The offer made in October 1968 to acquire for cash the whole share capital of Bain and Hodge Limited, transport contractors, was accepted by over 90% of the shareholders and the balance of shares will be taken over in due course. Henceforward Bain and Hodge results will be consolidated with BOC figures. The experience of Bain and Hodge in the transport of refrigerated foodstuffs, allied to our own expertise, should enable us to develop this side of our business much more quickly.

The cash offer made this month for the whole share capital of Batchelors Ltd, Dublin, is also to enable us to gain further impetus in the service we intend to offer to the food industry.

JOINT COMPANIES

The joint venture in chemical plant building, formed a year ago in conjunction with Air Reduction Company Inc of New York (of which the British component is BOC-Airco Cryogenic Plant Ltd), recently obtained a £2 million contract to build two large air separation plants, each with a capacity of 2,100 tons of oxygen and nitrogen per day, for Big Three Industrial Gas and Equipment Company of Houston, Texas. BOC-Airco also has substantial contracts from the parent companies for their internal requirements and the works at Edmonton should be fully occupied.

Seaflame Conversion Ltd, formed in conjunction with Donald Cameron Holdings Ltd to undertake domestic, commercial and industrial conversion work arising from the introduction of North Sea gas, had a favourable first year. The company has been increasingly successful in obtaining contracts for industrial conversion and at the end of 1968 won its first major contract for domestic conversion.

A joint company, BOC-Linde Refrigeration Ltd, has been formed since the end of the financial year with Linde AG of Germany, to cater for the UK market for commercial and industrial mechanical refrigeration and deep-freeze equipment. The company's factory at South Ruislip will offer a wide range of equipment from small plug-in deep freeze units to large cold stores and other facilities for industry. Over forty different models of high-quality refrigerated food display cabinets with which Linde have had conspicuous success on the Continent will now be available in the UK.

OVERSEAS

Devaluation brought an increase of over £1 million in the sterling value of the profits earned by our overseas companies and there was an appreciable improvement in trading results in most countries.

Continued overleaf

REPORT OF THE DIRECTORS *continued*

Record results were achieved in South Africa, Australia, Singapore and Malaya, and Hong Kong. In Canada and New Zealand, despite restrained economic conditions, results were in line with previous experience and in Pakistan there was a good advance despite interruptions in raw material supplies and difficulties of imports.

Political and economic troubles in India upset the activities of many of the principal users of our products, but fortunately our trading was less damaged than might have been feared though profits were reduced. In Ceylon, profits improved but new currency arrangements have added to a generally difficult trading environment. Our Burma company was nationalised recently along with a number of others, but this does little more than give official recognition to a *de facto* situation that has existed for some time.

Elsewhere, changes have been of less consequence and usually favourable.

EXPORTS

The value of goods exported by the group from the United Kingdom was as follows :–

to BOC companies	£2,273,819
to other customers	£9,007,427
	£11,281,246

DIRECTORS AND AUDITORS

The Directors are named on page one and there were no other Directors during the year.

The Directors retiring by rotation are Mr J L Hardie and Sir Owen Wansbrough-Jones KBE, CB, who are willing to be reappointed.

The Auditors, Cooper Brothers & Co., continue in office in accordance with Section 159(2) of the Companies Act 1948.

ANNUAL GENERAL MEETING

The Notice of the Annual General Meeting includes resolutions for amendment of the Memorandum and Articles of Association and has been printed separately for the convenience of shareholders. Attention is drawn to the explanatory statement at the end of the Notice.

FURTHER INFORMATION IN COMPLIANCE WITH THE REQUIREMENTS OF THE COMPANIES ACT 1967 AND THE STOCK EXCHANGE, LONDON.

DIRECTORS

The Register kept by the Company for the purpose of Section 27 of the Companies Act 1967 shows that the number of Ordinary shares and amounts of Stock of the Company in which the Directors of the Company and their families had an interest as at 27th October 1967 and 30th September 1968 were as follows :—

Director	*Class of Shares/ Stock*	*Number of Shares/ Value of Stock Held 27 Oct. 67*	*Held 30 Sept. 68*
Mr J S Hutchison	Ordinary	50,000	55,000
As Trustee	Ordinary	16,000	17,600
As Trustee	5¾% Debenture	£5,275	£5,275
As Trustee	6¾% Debenture	£10,450	£10,450
Sir Geoffrey C R Eley	Ordinary	7,450	12,595
As Trustee	Ordinary	3,590	4,174
As Trustee	7½% Convertible Unsecured Loan	£272	£1,750
Dr N Gross	Ordinary	2,593	2,852
Mr L E Smith	4% Cumulative 2nd Preference	£500	£500
Sir Duncan L Anderson	Ordinary	5,000	5,500
Mr P S Beale	Ordinary	10,000	11,000
Sir John G Cowley	Ordinary	2,000	2,200
Mr John L Hardie	Ordinary	32,200	35,500
As Trustee	Ordinary	16,000	17,600
As Trustee	5¾% Debenture	£5,275	£5,275
As Trustee	6¾% Debenture	£11,190	£11,190
Sir Owen Wansbrough-Jones	Ordinary	4,800	5,280

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CY-6-H

REPORT OF THE DIRECTORS *continued*

No Director has a financial interest in any shares or debentures of subsidiary companies.

The interests of the Directors and their families, in aggregate, do not exceed 5% of the share capital or votes of the Company or of any of its subsidiary companies.

No Director has a service contract which does not expire, or which is not determinable by the Company without payment of compensation, within one year.

There are no schemes to benefit Directors by enabling them to buy shares or debentures of the Company or any other company.

None of the Directors had a beneficial interest in any significant contract to which the parent Company or a subsidiary was a party during the financial year.

INTERESTS IN COMPANY'S SHARE CAPITAL

So far as can be ascertained no one person or corporation holds or is beneficially interested in any substantial part of the share capital of the Company.

CHARITABLE AND POLITICAL CONTRIBUTIONS

During the year ended 30th September 1968 the UK companies made charitable and educational payments totalling £23,886.

In accordance with long established practice no political contributions were made by the group in the United Kingdom except that Edwards High Vacuum International Ltd made a payment of £75 to the Economic League before acquisition was completed.

SHARE AND LOAN CAPITAL

During the year the following new issues were made:

6,907,887	Ordinary shares of 5/- each for the acquisition of the ordinary share capital of Edwards High Vacuum International Limited.
18,350,200	Ordinary shares of 5/- each at 10/6 per share to Ordinary shareholders and holders of 7½% Convertible Unsecured Loan Stock 1987/92. At 30th September 1968 5/- per share was paid up of which 2/6 per share represented premium.
£7,500,000	8½% Tonnage Debenture Stock 1990 for cash at par. At 30th September 1968 £1,875,000 was paid up.

The rights issue of Ordinary shares and the Tonnage Debenture Stock issue were made to enable the Company to repay the UK bank borrowings and to be in a flexible position for development.

EMPLOYEES IN THE GROUP

Numbers and remuneration are as follows:

	Average number employed	Aggregate remuneration
UK	16,484	£20,515,242
Overseas	15,105	£14,794,263
Total	31,589	£35,309,505

By order of the Board

C A B Leslie

Secretary

London

30th January 1969

EX-6-I

A 3622

THE BRITISH OXYGEN COMPANY LIMITED

CHAIRMAN'S STATEMENT

PROFITS, RESERVES AND CAPITAL

Sales increased overall last year by £34,377,396, but this figure included for the first time sales by Murex and EHV and was swollen by the devaluation uplift in overseas figures; on figures comparable with the preceding year trading increased by £8,885,353. Profits attributable to the parent Company improved, after tax, by £1,164,194 to £5,635,835, to which has to be added exceptional profits of £287,231, mainly from the sale of a factory site.

Capital and revenue reserves increased by some £7 million primarily from the devaluation uplift in the sterling value of the net assets of overseas subsidiaries and the £2,549,392 credited from premium on capital issues less expenses.

The Directors consider it proper this year to recommend the small increase in dividend appropriate under present regulations and accordingly propose a final dividend of 7.35% less tax (against 7%), leaving £1,373,723 of the year's profit retained.

The capital and loan issues made in July 1968 are now fully subscribed and added £16,775,600 to our funds which was more than sufficient to eliminate our UK bank overdraft. We thus find ourselves in a position of liquidity from which to proceed with our various plans for extension at this time of severe financial restriction.

Orders placed for capital expenditure by the group at 30th September 1968 amounted to £7,700,000, and further capital expenditure authorised by the Directors but not contracted at that date amounted to £14,700,000. These figures are in line with previous experience and reflect the constant capital extension required in order to meet sales growth, and the general extension of our interests. In comparison group cash flow is now over £13 million per annum.

UK TRADING

Although part of the increase in our UK profits came from larger sales, a much greater portion was due to improved operational efficiency and the fuller development of marketing policies. Close management concentration on such immediate issues was not, however, allowed to divert attention from planning for the longer term on which much new work has been done.

Stage 1 of our productivity agreements in Gases Division was in operation last year. Stage 2 has been under negotiation during the year, and we are hopeful that full acceptance will be reached during 1969. We have greatly valued the very considerable assistance the unions have given us in working out the new pattern which we believe may come to be regarded as a major landmark in the advance into the era of genuine productivity agreements—a development we believe to be essential to national economic good health.

The extensions of our UK interests referred to in the Directors' Report are designed to strengthen existing resources or to give impetus to our plans to advance in directions complementary to present activities, as is the offer for Batchelors Ltd Dublin, made a few days ago.

OVERSEAS

Export of many of our products—particularly gases—is neither practicable nor economic and much of our manufacture accordingly has to take place within each country and near to the point of sale. This leads to constant expansion in the establishments and resources of our overseas companies and to a steady growth in their annual earnings which now total over £3.8 million after overseas tax.

The authorities are naturally anxious to promote quick correction in the balance of payments and lay great stress on export sales, but these fluctuate and are usually won in hard competition at prices that may yield little final profit, often with very extended payment terms. Our own experience in export trading, covering many different products and totalling over £11 million last year, has left us in no doubt as to the value to be obtained by operating through local companies and by local production.

It is to be hoped that before too long greater recognition can be given to the value on the receipts side of the balance of payments of the dependable and repetitive income obtained from the operations conducted overseas by many leading British companies, and encouragement given once more for overseas investment which in the past has proved so great a source of strength to the nation and which undoubtedly will be vitally needed in the future if we are to re-establish our prosperity on a permanent basis.

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CHAIRMAN'S STATEMENT *continued*

Almost all of our overseas companies made strong progress last year. One or two had to fight hard to maintain position in adverse national circumstances, and in India we were fortunate to emerge with a maintained dividend and much less loss of ground than was the general experience. Congratulations are certainly due to our overseas Managing Directors and management teams for their success last year and to the Chairmen and Directors who guide their development from their knowledge and experience of local conditions.

It has pleased us very much that we have been able in the past year to extend and develop group participation in the management skills and techniques of especial value in our business. International conferences of Managing Directors and top executives—the last in London in May 1968, the next in Sydney in March 1969—have been of immense value to all concerned and typify the effort we make to encourage management development and initiative throughout the group.

MEMORANDUM AND ARTICLES OF ASSOCIATION

The rights issue of 18,350,200 shares during 1968, and the issue of shares for companies acquired, has reduced the unissued share capital to £5,141,015, of which £3,104,062 is earmarked for holders of the convertible unsecured loan stock. We consider it prudent to restore a moderate reserve of unissued shares and it is proposed that a resolution be considered at the Annual General Meeting, as special business, to increase the authorised share capital by £5,000,000.

Whilst the Company is at present happily placed in regard to liquid funds, it is growing constantly and we need to be sure that its plans are not hindered by inadequate borrowing powers. It has therefore been considered advisable to modernise the borrowing limits in the Articles so as to give us power to borrow up to one and a half times the amount of issued share capital and group reserves. Borrowings are presently limited to a sum equal to the Company's issued share capital and group reserves. Whilst this has not hampered us in the past, circumstances, both fiscal and operational, have been changing and we believe that wider powers are now desirable if the Directors are to regulate the Company's financing to the best advantage.

The opportunity is being taken at the same time to make a number of lesser alterations in the Memorandum and Articles of Association to reflect changes brought about by modern practice or required by the Companies Act 1967, and to provide a constitution in keeping with the Company's present and possible future requirements. The changes are fully detailed in the accompanying formal notice.

MANAGEMENT AND STAFF

It is difficult, with a total staff of well over thirty thousand people at home and overseas, to do justice to the sterling contributions made by so many individuals at all levels. We benefit enormously from a great fund of initiative, unsparing work and loyalty throughout the organisation; its origin is in the splendid leadership of Mr L E Smith and Dr N Gross, our joint managing directors, the home chief executives and principal officers, and the managing directors and management teams overseas. To all I extend sincere thanks.

PROSPECTS

A year ago we expected that there would be a growing trend of improvement in our affairs; this happened.

Looking forward now I expect profit growth to continue and to strengthen as the year goes on, both at home and overseas.

We operate in many countries with ever-changing political and economic circumstances which could upset the best of estimates. Nonetheless I am confident that we should report a further appreciable improvement in profits for 1968/69.

London
30th January 1969

J S Hutchison

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THE BRITISH OXYGEN COMPANY LIMITED

REPORT OF THE AUDITORS

To the Members of The British Oxygen Company Limited

In our opinion, based on our examination and the reports of the auditors of certain subsidiaries not audited by us, the accounts set out on pages 9 to 17 together give a true and fair view of the state of affairs at 30th September 1968 and of the profit for the year ended on that date and comply with the Companies Acts 1948 and 1967.

Cooper Brothers & Co
Chartered Accountants

London
30th January 1969

THE BRITISH OXYGEN COMPANY LIMITED AND SUBSIDIARY COMPANIES

C4-6-L

CONSOLIDATED PROFIT AND LOSS ACCOUNT

	1968 £	1967 £
Sales	134,363,407	99,986,011
Trading profit		
United Kingdom	6,331,827	5,033,215
Overseas	10,884,010	8,002,372
	17,215,837	13,035,587
Interest paid—United Kingdom	3,057,714	2,141,459
Overseas	885,696	734,088
	13,272,427	10,160,040
Taxation—note 4, page 14	6,000,436	4,439,583
	7,271,991	5,720,457
Attributable to minority shareholders	1,636,156	1,248,816
Trading profit after tax attributable to parent Company	5,635,835	4,471,641
Exceptional profits less losses, after tax adjustments—note 7, page 15	287,231	1,555,895
Available for disposal	£5,923,066	£6,027,536
Dividends:		
Preference	122,500	122,500
Ordinary: interim 3%	1,283,143	1,231,334
proposed final 7.35% (1967 7%)	3,143,700	2,873,112
	4,549,343	4,226,946
Retained	1,373,723	1,800,590

This Consolidated Profit and Loss Account should be read in conjunction with the notes on pages 14 and 15.

£5,923,066	£6,027,536

Cx-6-M

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THE BRITISH OXYGEN COMPANY LIMITED AND SUBSIDIARY COMPANIES

CONSOLIDATED BALANCE SHEET 30th SEPTEMBER 1968

			1968 £	1967 £
Issued share capital of The British Oxygen Company Limited			47,565,210	43,544,464
Reserves				
Capital:				
Debenture redemption		786,361		654,337
Share premium		2,293,775		—
Other		9,316,958		4,150,206
		12,397,094		4,804,543
Revenue:				
Reserves and unappropriated profits:				
The British Oxygen Company Limited	12,147,174			12,851,874
Subsidiary companies	8,503,096			7,096,172
		20,650,270		
			33,047,364	24,752,589
Total capital and reserves			80,612,574	68,297,053
Interests of minority shareholders			13,579,924	10,819,068
Tax equalisation			7,156,641	6,120,660
Loans—note 2, page 16			41,562,228	34,771,138
Current liabilities and provisions				
Bank overdrafts (secured £720,913)		11,187,029		18,594,284
Creditors and accrued liabilities		20,425,286		13,295,913
Taxation—United Kingdom		1,702,151		1,257,230
Overseas		4,166,168		3,031,740
Proposed final ordinary dividend		3,143,700		2,873,112
			40,624,334	39,052,279
			£183,535,701	£159,060,193

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THE BRITISH OXYGEN COMPANY LIMITED AND SUBSIDIARY COMPANIES

CONSOLIDATED BALANCE SHEET 30th SEPTEMBER 1968

	Cost or valuation	Depreciation	1968	1967
Fixed assets	£	£	£	£
Freehold and leasehold properties	34,085,991	9,645,539	24,440,452	21,308,956
Plant and machinery	102,850,077	50,872,636	51,977,441	46,247,305
Cylinders	42,510,332	23,041,973	19,468,359	17,277,040
Motor vehicles	8,877,251	4,140,029	4,737,222	4,169,085
Furniture and fixtures	4,524,898	2,935,276	1,589,622	1,213,350
	£192,848,549	£90,635,453	102,213,096	90,215,736
Subsidiary company not consolidated			—	8,126,737
Investments				
Shares at cost		3,040,264		2,479,265
Less amounts written off		671,638		669,665
		2,368,626		1,809,600
Add amounts owing to Group Companies		1,906,175		5,387,654
		4,274,801		7,197,254
Less amounts owing by Group Companies		1,542,325		—
		—	2,732,476	7,197,254
Current assets				
Stock and work in progress		33,743,732		23,688,742
Debtors and payments in advance		37,253,394		24,790,307
Investment grants receivable		3,295,185		3,494,942
Tax reserve certificates		108,500		85,000
Deposits at short call		1,545,374		664,207
Cash and bank balances		2,643,944		797,273
			78,590,129	53,520,471
			£183,535,701	£159,060,198

J S Hutchison *Director*

Geoffrey Eley *Director*

This Balance Sheet should be read in conjunction with the notes on pages 15 to 17

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CX-6-0

THE BRITISH OXYGEN COMPANY LIMITED

BALANCE SHEET 30th SEPTEMBER 1968

		1968 Authorised	1968 Issued	1967
		£	£	£
Capital				
6½% Cumulative Preference Stock		500,000	500,000	500,000
5% Cumulative Second Preference Stock		1,000,000	1,000,000	1,000,000
4% Cumulative Second Preference Stock		1,000,000	1,000,000	1,000,000
Ordinary shares of 5s.		42,771,435	42,771,435	41,044,464
Ordinary shares of 5s. (2s. 6d. paid)		4,587,550	2,293,775	—
Shares of 5s.		5,141,015	—	—
		£55,000,000	47,565,210	43,544,464
Reserves				
Capital:				
Debenture redemption		786,361		654,337
Share premium		2,293,775		—
Other		1,999,157		1,225,784
		5,079,293		1,880,121
Revenue:				
General	11,000,000			11,000,000
Unappropriated profit	1,147,174			1,851,874
		12,147,174		
			17,226,467	14,731,995
Total capital and reserves			64,791,677	58,276,459
Tax equalisation			6,031,250	5,550,000
Loans—note 2, page 16			32,474,036	27,979,382
Current liabilities and provisions				
Bank overdrafts—unsecured		8,179,547		15,961,978
Creditors and accrued liabilities		7,863,293		6,689,184
Taxation—United Kingdom		668,057		1,018,505
Overseas		176,451		137,960
Proposed final ordinary dividend		3,143,700		2,873,112
			20,031,048	26,680,739
			£123,328,011	£118,486,580

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EX-6-P

THE BRITISH OXYGEN COMPANY LIMITED

BALANCE SHEET 30th SEPTEMBER 1968

	Cost	Depreciation	1968	1967
	£	£	£	£
Fixed assets				
Freehold and leasehold properties	13,386,634	3,768,874	9,617,760	9,949,478
Plant and machinery	59,793,755	28,987,894	30,805,861	29,312,759
Cylinders	18,479,033	10,627,050	7,851,983	7,684,100
Motor vehicles	6,101,805	2,495,503	3,606,302	3,188,077
Furniture and fixtures	1,833,792	1,253,188	580,604	624,644
	£99,595,019	£47,132,509	52,462,510	50,759,058
Subsidiary companies				
Shares at cost and scrip issues at par, *less* amounts written off		22,842,487		20,235,843
Amounts owing, including dividends since declared		18,235,912		15,758,781
		41,078,399		35,994,624
Less amounts owing to subsidiary companies, *less* dividends since declared		434,118		470,061
			40,644,281	35,524,563
Investments				
Shares at cost		949,095		953,273
Less amounts written off		108,529		108,529
		840,566		844,744
Add amounts owing to parent Company		947,073		4,477,379
		1,787,639		5,322,123
Less amounts owing by parent Company		1,526,636		—
			261,003	5,322,123
Current assets				
Stock and work in progress		9,852,651		10,147,849
Debtors and payments in advance		17,811,266		13,892,918
Investment grants receivable		2,259,618		2,787,549
Cash and bank balances		36,682		52,520
			29,960,217	26,880,836
			£123,328,011	£118,486,580

J S Hutchison *Director*

Geoffrey Eley *Director*

This Balance Sheet should be read in conjunction with the notes on pages 15 to 17

Ex-6-Q

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NOTES ON CONSOLIDATED PROFIT AND LOSS ACCOUNT

1 Sales are based on invoiced value excluding inter-company sales.

	1968	1967
	£	£
2 Trading profit shown is after charging:		
Depreciation—United Kingdom	6,301,956	5,291,784
Overseas	4,286,716	3,420,362
	10,588,672	8,712,146
Pension and provident funds contributions	1,550,812	1,278,240
Audit fees (parent Company £19,510)	108,632	78,601
Emoluments of directors of parent Company:		
as directors	7,500	7,500
for management	82,624	70,141
Payments to past directors and dependants of past directors of parent Company	24,589	25,143
	£12,362,829	£10,171,771
and after crediting:		
Investment income—quoted	104	19
unquoted	155,382	314,750
	£155,486	£314,769
3 Interest paid:		
Bank loans, overdrafts and other loans repayable within five years	1,348,083	1,007,285
All other loans	2,595,327	1,868,262
	£3,943,410	£2,875,547
4 Taxation on profit of year:		
United Kingdom—corporation tax at 42½%	2,666,171	1,227,591
tax equalisation	448,744	1,159,000
	3,114,915	2,386,591
Reduced by—double taxation relief	1,813,000	1,178,000
overspill relief (current year)	121,978	—
	1,179,937	1,208,591
Overseas—taxes	4,504,722	3,162,490
tax equalisation	315,777	68,502
	£6,000,436	£4,439,583
5 Directors' emoluments:		
Chairman	£15,260	£14,760
Highest paid director	£17,310	—
	Number	Number
Up to £2,500	5	5
£5,001 to £7,500	—	1
£7,501 to £10,000	1	—
£12,501 to £15,000	—	3
£15,001 to £17,500	3	—
Emoluments waived (nine directors)	£12,500	£12,500
6 Senior employees' emoluments:	Number	Number
£10,001 to £12,500	1	—

NOTES ON CONSOLIDATED PROFIT AND LOSS ACCOUNT *continued*

		£	£
7	Exceptional profits less losses after tax adjustments:		
	Profit on sale of fixed assets	516,324	
	Less tax	82,500	
			433,824
	Overspill relief (prior year)		121,978
			555,802
	Deduct exceptional costs of commissioning new plants	455,851	
	Less tax	187,280	
			268,571
			£287,231

8 The unappropriated profits of overseas subsidiary companies are liable to overseas and United Kingdom taxation if distributed as dividends.

9 Profits for the Murex and Edwards High Vacuum groups cover periods of 17 and 7 months respectively to 30th September 1968.

NOTES ON BALANCE SHEETS

1 Movements in reserves during year	Parent Company £	Consolidated £
Capital		
Balance at 1st October 1967	1,880,121	4,804,543
Increase arising from devaluation	—	2,857,725
Retained (part of £1,373,723)	132,024	99,167
Premium on issue of shares—parent Company	2,293,775	2,293,775
subsidiary company	—	634,868
Transfer from revenue reserves	—	1,590,031
Scrip issues by subsidiary companies	1,144,127	—
Revaluation of fixed assets in an overseas subsidiary company	—	353,968
Others	Dr. 12,500	121,271
	5,437,547	12,755,348
Less:		
Tonnage and rights issue expenses	358,254	358,254
	£5,079,293	£12,397,094
Revenue		
Balance at 1st October 1967	12,851,874	19,948,046
Increase arising from devaluation	—	1,213,102
Retained (part of £1,373,723)	Dr. 704,700	1,274,556
	12,147,174	22,435,704
Less:		
Transfer to capital reserves	—	1,590,031
Goodwill on acquisition of a subsidiary company	—	88,027
Transfer to minorities	—	86,379
Tax on scrip issue	—	20,997
	£12,147,174	£20,650,270

Continued overleaf

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THE BRITISH OXYGEN COMPANY LIMITED AND SUBSIDIARY COMPANIES

NOTES ON BALANCE SHEETS *continued*

2 Loans	1968 £	1967 £
Parent Company:		
5¾% Debenture Stock 1981/86—secured	9,074,036	9,204,382
6¾% Debenture Stock 1985/90—secured	7,000,000	7,000,000
8½% Tonnage Debenture Stock 1988—secured	6,000,000	6,000,000
8½% Tonnage Debenture Stock 1990—secured (£7,500,000 part paid)	1,875,000	—
7½% Convertible Unsecured Loan Stock 1987/92	5,775,000	5,775,000
Industrial Reorganisation Corporation 7½% 1976—unsecured	2,500,000	—
Board of Trade, repayable 1969, interest free and unsecured	250,000	—
	32,474,036	27,979,382
Subsidiary Companies:		
7½% Debenture Stock 1986/91—secured	1,000,000	—
7% Debenture Stock 1971—secured	307,907	263,745
7% Debenture Stock 1974—secured	414,233	316,155
7½% Debenture Stock 1976—secured	545,209	467,012
7½% Debenture Stock 1983—secured	981,116	706,932
7¾% Debenture Stock 1981—secured	3,332,930	2,854,900
Other Debenture and Mortgage Loans:		
Repayable within 5 years (Secured £342,815, 1967 £98,084)	577,844	215,170
Others (Secured £1,636,296, 1967 £1,717,034)	1,928,953	1,967,842
	£41,562,228	£34,771,138

The other debenture and mortgage loans are repayable over the years 1969 to 1986 and carry interest rates varying between nil and 9¾%.

3 Investments	Parent Company £	Consolidated £
Quoted (Market value £81,985)	—	81,515
Unquoted—equity at Directors' valuation	838,641	2,226,485
others at Directors' valuation	1,925	60,626
	£840,566	£2,368,626

4 Stock and work in progress is included at cost or net realisable value whichever is lower, and cost where appropriate includes a proportion of overhead expenses.

5 Assets and liabilities in currency have been converted at rates ruling at 30th September 1968.

6 There were projects for expenditure on capital account against which orders had been placed by the Group to the extent of £7,700,000 of which £5,500,000 related to parent Company: Capital expenditure authorised by the Directors, against which orders had not yet been placed amounted to £14,700,000 of which £12,700,000 related to parent Company.

7 The parent Company has contingent liabilities amounting to £4,034,754 in respect of bank and other guarantees, the majority on behalf of subsidiary and other companies. A subsidiary company has a contingent liability of £56,709 in respect of a guarantee to another company.

8 A subsidiary company has a liability for the payment of goodwill not exceeding £440,000 for which no provision has been made.

9 The unappropriated profits of overseas subsidiary companies are liable to overseas and United Kingdom taxation if distributed as dividends.

10 The Company is under obligation to contribute to the Trustees of The British Oxygen Company's Staff and Works Pension Funds, in respect of improved benefits to employees, £56,550 per annum until 31st March 1972. Two overseas subsidiary companies are under obligation to contribute to the Trustees of their Pension Funds £46,512 per annum over periods varying from seven to seventeen years.

11 There are exchange control restrictions in certain overseas countries on the remittance of funds to the UK.

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12 Group fixed assets

	Cost or valuation 1.10.67 £000s	New subsidiaries £000s	Increase due to devaluation £000s	Capital expenditure £000s	Demolitions and sales £000s	Cost or valuation 30.9.68 £000s
Freehold and leasehold properties	28,503	3,050	2,089	1,193	749	34,086
Plant and machinery	86,385	6,682	3,936	7,489	1,642	102,850
Cylinders	36,716	51	2,884	3,096	237	42,510
Motor vehicles	7,610	218	291	1,426	667	8,878
Furniture and fixtures	3,376	668	210	321	50	4,525
	162,590	10,669	9,410	13,525	3,345	192,849

Capital expenditure is after deducting UK investment grants £3,802,515.
Four overseas companies revalued certain fixed assets in 1966 and 1967, which increased their then book values by £850,000 approx. An overseas company revalued its fixed assets at 30.9.68 which increased its book values by £353,968. Freehold properties were valued by an insurance company, and plant, machinery and cylinders by the Company, both being on a replacement value basis.

Depreciation:	Depreciation 1.10.67 £000s	New subsidiaries £000s	Increase due to devaluation £000s	Provided during year £000s	Demolitions and sales £000s	Depreciation 30.9.68 £000s
Freehold and leasehold properties	7,194	1,247	530	964	290	9,645
Plant and machinery	40,137	4,212	1,860	5,978	1,314	50,873
Cylinders	19,439	16	1,464	2,330	207	23,042
Motor vehicles	3,441	144	163	979	586	4,141
Furniture and fixtures	2,163	373	131	337	69	2,935
	72,374	5,992	4,148	10,588	2,466	90,636

The value of freehold and leasehold properties at 30.9.68 included above is:

	Cost (£000s) UK	Cost (£000s) Overseas	Depreciation (£000s) UK	Depreciation (£000s) Overseas
Freehold	11,109	14,726	3,658	3,795
Leasehold—long term	4,043	1,911	978	417
short term	1,532	765	549	248
	16,684	17,402	5,185	4,460

13 Parent Company fixed assets

	Cost 1.10.67 £000s	Capital expenditure £000s	Demolitions and sales £000s	Cost 30.9.68 £000s
Freehold and leasehold properties	13,564	480	658	13,386
Plant and machinery	56,060	4,860	1,126	59,794
Cylinders	17,496	1,147	164	18,479
Motor vehicles	5,420	1,085	403	6,102
Furniture and fixtures	1,772	102	40	1,834
	94,312	7,674	2,391	99,595

Capital expenditure is after deducting UK investment grants £3,528,177.

Depreciation:	Depreciation 1.10.67 £000s	Provided during year £000s	Demolitions and sales £000s	Depreciation 30.9.68 £000s
Freehold and leasehold properties	3,615	408	254	3,769
Plant and machinery	26,748	3,154	914	28,988
Cylinders	9,812	922	107	10,627
Motor vehicles	2,231	623	358	2,496
Furniture and fixtures	1,147	145	39	1,253
	43,553	5,252	1,672	47,133

The value of freehold and leasehold properties at 30.9.68 included above is:

	Cost £000s	Depreciation £000s
Freehold	7,975	2,291
Leasehold—long term	3,921	955
short term	1,490	523

14 Depreciation is calculated to write off the assets during their expected normal lives by equal annual instalments (the straight line method) at rates ranging from 2½% to 25% per annum, depending upon the type of asset.

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THE BRITISH OXYGEN COMPANY LIMITED AND SUBSIDIARY COMPANIES

COMPARISON OF RESULTS

	1959 £000s	1960 £000s	1961 £000s	1962 £000s
GROUP SALES AND PROFITS	← Income tax/Profits tax system applicable			
Sales	54,882	59,778	62,510	67,987
Profit before interest and taxation	9,302	10,274	9,352	9,302
less **interest**	715	758	742	840
Profit before taxation	8,587	9,516	8,610	8,462
Profit after taxation attributable to ordinary shareholders (Investment allowances excluded for 1965 and 1966)	3,861	4,352	4,642	4,311
Exceptional profits less losses	—	—	—	—
Earnings per ordinary share (Note 2) (excluding exceptional items)	← Applicable to corporation tax period only			
CAPITAL EMPLOYED				
Ordinary shareholders' capital and reserves	34,630	37,317	52,216	54,902
Deferred taxation	4,084	4,459	3,519	3,987
Preference stockholders' capital	2,500	2,500	2,500	2,500
Interests of minority shareholders	3,774	4,168	4,867	5,252
Loan capital (including bank overdrafts)	12,813	12,817	12,763	19,814
	57,801	61,261	75,865	86,455
RETURN ON AVERAGE CAPITAL EMPLOYED (Note 3) (Based on trading profit before interest and taxation)	16·6%	17·3%	13·6%	11·5%
ISSUED ORDINARY SHARE CAPITAL (Note 2)	£000s 17,047	£000s 17,047	£000s 30,683	£000s 30,683
ORDINARY DIVIDEND RATES (adjusted for scrip and rights issues)	6·5%	7·5%	8%	8%
NUMBER OF EMPLOYEES				
United Kingdom	14,000	15,100	16,100	15,400
Overseas	9,900	10,600	10,900	11,500

Notes: 1. In 1966 £2,500,000 was written off small capacity plants against which a similar amount was released from reserves.
2. Excluding initial instalment of rights issue made in 1968.
3. Capital employed adjusted for subsidiary company not consolidated in 1967 £8,127,000.

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THE BRITISH OXYGEN COMPANY LIMITED AND SUBSIDIARY COMPANIES

1963 £000s	1964 £000s	1965 £000s	(Note 1) 1966 £000s	1967 £000s	1968 £000s
		Corporation tax system applicable			
73,363	84,437	92,026	95,297	99,586	134,363
10,275	12,647	13,281	12,019	13,036	17,216
1,158	1,197	1,406	1,969	2,876	3,944
9,117	11,450	11,875	10,050	10,160	13,272
5,144	5,409	5,341	4,229	4,349	5,514
—	—	—	—	1,556	287
		7·8d	6·2d	6·3d	7·7d
57,887	61,082	64,920	63,227	65,797	78,113
4,862	6,081	4,724	4,482	6,121	7,157
2,500	2,500	2,500	2,500	2,500	2,500
6,028	8,458	9,969	10,239	10,819	13,580
24,121	20,624	27,122	36,133	53,365	52,749
95,398	98,745	109,235	116,581	138,602	154,099
11·3%	13·0%	12·8%	10·6%	10·6%	12·1%
£000s	£000s	£000s	£000s	£000s	£000s
30,783	41,044	41,044	41,044	41,044	42,771
9%	10%	11%	10%	10%	10·4%
14,700	14,500	15,400	15,500	13,200*	16,500†
12,600	13,500	14,100	14,500	14,800	15,100

*Excludes BOC-Airco Cryogenic Plant Ltd.
†Includes Murex and Edwards High Vacuum.

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BOC PRINCIPAL GROUP COMPANIES

	BOC Percentage of Shares held	
United Kingdom	—	**The British Oxygen Company Ltd.**
	90	Bain and Hodge Ltd. (acquired since 30/9/68)
	50	BOC-Airco Cryogenic Plant Ltd.
	60	BOC-Linde Refrigeration Ltd. (formed since 30/9/68)
	100	BOC Holdings Ltd.
	100	British Industrial Gases Ltd.
	100	British Oxygen Chemicals Ltd.
		Edwards High Vacuum International Ltd.
	100	Ordinary
	100	6½% Cum. Pref.
	67	Hirst Welding Rectifiers Ltd.
	*25	Methane Gas Engineering Ltd.
		Murex Ltd.
	100	Ordinary
	100	7% Cum. Pref.
	100	4% Cum. Red. Pref.
	*100	Murex Welding Processes Ltd.
	51	Seaflame Conversion Ltd.
Australia	58	The Commonwealth Industrial Gases Ltd.
	*30	Arnold-DeVilbiss Pty. Ltd.
Burma	100	Burma Oxygen Ltd.
Canada	100	Canadian Oxygen Ltd.
	33	Canadian Helium Ltd.
	*100	Edwards High Vacuum (Canada) Ltd.
Ceylon	100	Ceylon Oxygen Ltd.
Germany	100	BOC Deutschland G.m.b.H.
	*100	Edwards Hochvakuum G.m.b.H.
	*100	Heimsyphon G.m.b.H.
Hong Kong	100	British Oxygen (Hong Kong) Ltd.
	*50	Hong Kong Oxygen & Acetylene Co. Ltd.
India	66	Indian Oxygen Ltd.
Ireland		Industrial Gases (IFS) Ltd.
	32	'A' Voting
	97	'B' Non Voting
Italy	*100	Edwards Alto Vuoto S.p.A.
	*100	Fusarc Italiana S.p.A.
	50	Rivoira S.p.A.
	*100	Saccab S.p.A.
Kenya	*100	East African Oxygen Ltd.
Malaysia	100	Malayan Oxygen Sdn. Berhad
	100	Malayan Welding Products Sdn. Berhad
New Zealand	63	New Zealand Industrial Gases Ltd.
Nigeria	50	Industrial Gases Ltd.
Norway	100	Odda Smelteverk A/S
Pakistan	59	Pakistan Oxygen Ltd.
Rhodesia	*100	Rhodesia Oxygen (Pvt.) Ltd.
Sierra Leone	*50	Sierra Leone Oxygen Factory Ltd.
Singapore	100	Singapore Oxygen Pte. Ltd.
	100	Singapore Welding Pte. Ltd.
South Africa	*68	African Oxygen Ltd.
	*68	Oxygen & Thermal Industries (South Africa) Ltd.
Sweden	100	Svenska BOC AB
Tanzania	*100	Tanzanic Oxygen Ltd.
Uganda	*100	Uganda Oxygen Ltd.
USA	50	Airco-BOC Cryogenic Plants Corporation
	*100	Edwards High Vacuum Inc.
Zambia	100	Zambia Oxygen Ltd.

*Shares held by a subsidiary or associated company.

Note:

The above list includes all associated and subsidiary companies carrying on business the results of which, in the opinion of the Directors, principally affected the amount of the profit or loss or the amount of the assets of the Group. Except where otherwise indicated the shares held are ordinary shares. Associated and subsidiary companies of BOC not listed above will be shown in the next annual return.

Printed by St. Clements Foah & Cross Limited, London

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THE BRITISH OXYGEN COMPANY LIMITED

FORM OF PROXY (For use by Ordinary Shareholders only)

I_____
(BLOCK CAPITALS PLEASE)

of_____

being a member of the above named Company, hereby appoint JAMES SELLER HUTCHISON, or failing him, SIR GEOFFREY ELEY CBE, or failing him, LESLIE EDWARD GEORGE SMITH, all of Hammersmith House, London, W6, as my proxy to vote for me and on my behalf at the Annual General Meeting of the Company to be held at the Confederation of British Industry Council Chamber, 21 Tothill Street, London, SW1, at 11.30 am on the 25th day of February, 1969, and at any adjournment thereof.

Signed_____ Date_____ 1969.

Please indicate with a X in the spaces below how you wish your votes to be cast. If the form is returned without any indication as to how the proxy shall vote on any particular matter, the proxy will vote or abstain as he thinks fit.

RESOLUTIONS	FOR	AGAINST
1 To adopt the Report and Accounts		
2 To declare a dividend		
3 To re-elect Mr John L Hardie as a director		
4 To re-elect Sir Owen Wansbrough-Jones KBE CB as a director		
5 To authorise the Directors to fix the remuneration of the Auditors		
6 To increase the Authorised Capital		
7 To alter the Memorandum of Association		
8 To alter the Articles of Association		

Notes

1 This proxy must reach the registered office of the Company not less than 48 hours before the meeting.

2 A corporation's proxy must be under its Common Seal.

3 A form to appoint a proxy other than those named above will be supplied on request.

This Form of Proxy should only be completed by Ordinary Shareholders.

FOLD 2

Postage will be paid by Licensee.

1st CLASS

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BUSINESS REPLY SERVICE
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The Secretary,
THE BRITISH OXYGEN COMPANY LIMITED,
Hammersmith House,
London, W6

FOLD 1

FOLD 3

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TUCK IN

CX-6-2

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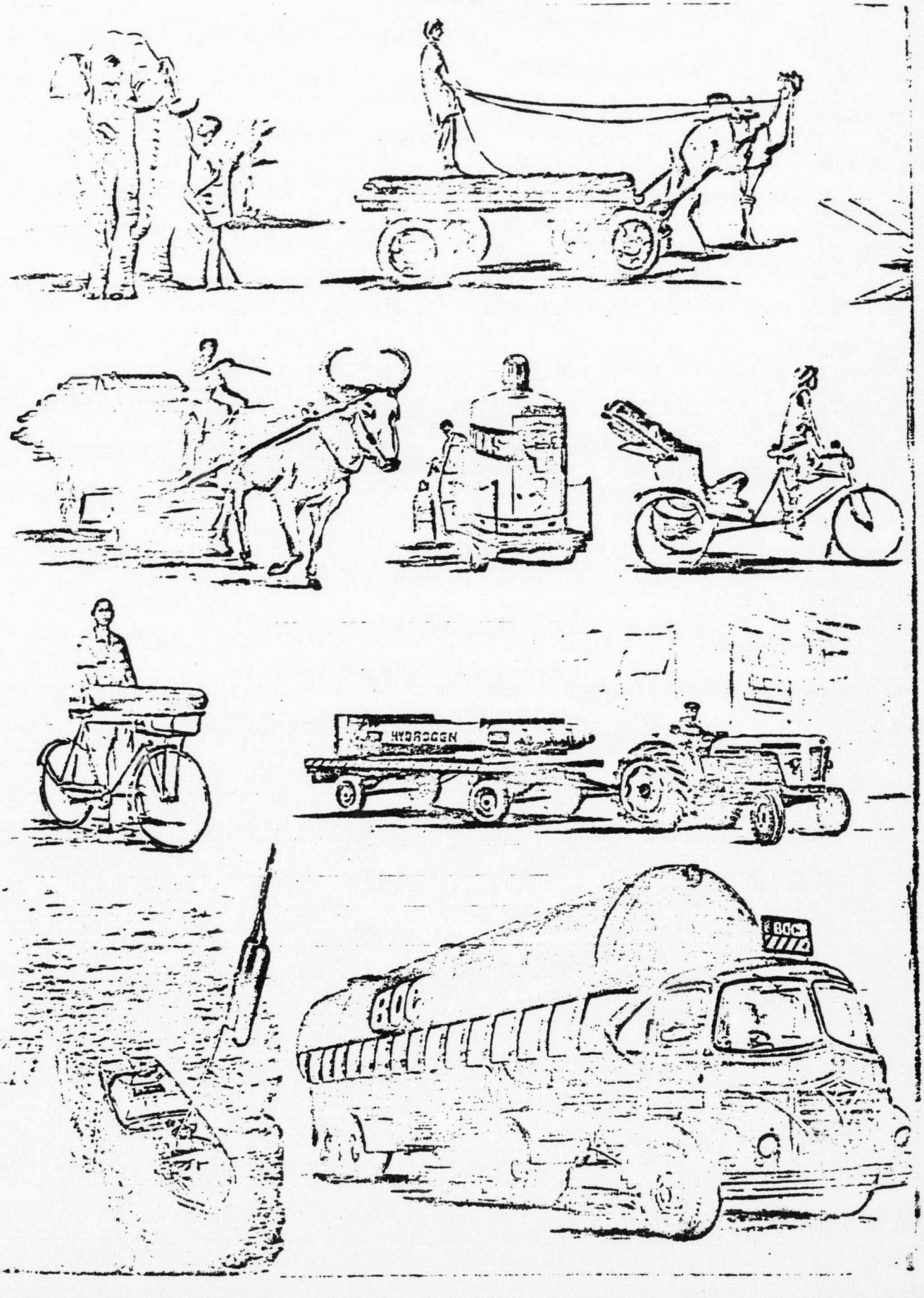

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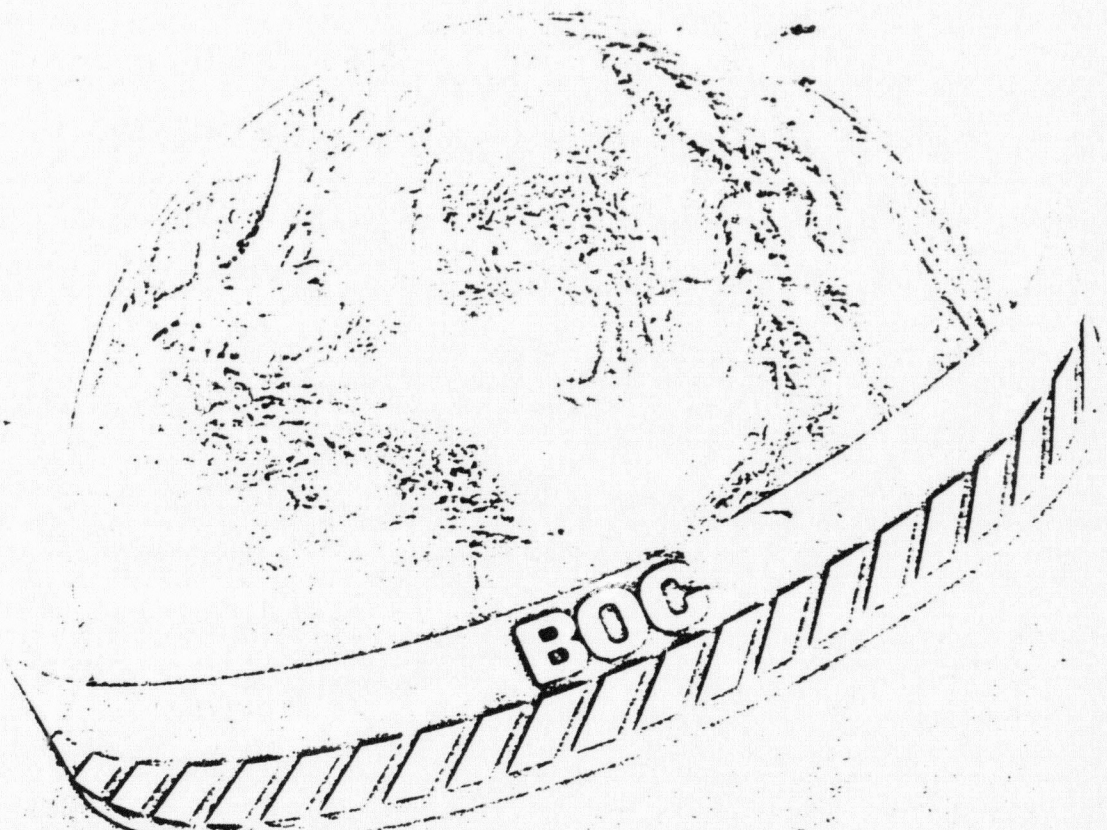

British Oxygen Company Report and Accounts 1970

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THE BRITISH OXYGEN COMPANY LIMITED CX-9-B

Directors' Report and Accounts 1970

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3	Notice of meeting.
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FRONT COVER The world is getting smaller and BOC, already serving all continents, is getting bigger. The photograph was taken from Apollo 13 on its flight to the moon, April 1970.

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2

SUMMARY OF GROUP RESULTS

The British Oxygen Company Limited and subsidiary companies

		1970	*1969*
		£'000	*£'000*
Profits and Dividends	Group profit before tax	18,515	*15,081*
	Taxation	8,548	*7,229*
	Exceptional profits less losses	350	*815*
	Dividends to BOC shareholders	6,114	*5,345*
	Profit retained	1,940	*1,416*
	Return on average capital employed (based on profit before interest and taxation)	12.5%	*11.5%*
	Earnings per ordinary share, excl. exceptional items	3.80p (9.1d)	*3.08p (7.4d)*

		1970	FIVE YEARS 1966–1970
		£'000	£'000
Source of funds	Retained profits	1,940	7,101
	Depreciation provisions	14,034	53,436
	Net financing from bankers	9,219	23,311
	Loan capital	(106)	30,475
	Share capital issued	4,486	15,967
	Other	856	4,449
		30,429	134,739
Application of funds	Expenditure on fixed assets	26,144	92,118
	Working capital	4,285	42,621
		30,429	134,739

Distribution of Group sales by continents

Europe	52%
Africa	20%
Australasia	15%
Asia	8%
America	5%

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3

NOTICE OF MEETING

The British Oxygen Company Limited

Notice is hereby given that the eighty-fifth Annual General Meeting of The British Oxygen Company Limited will be held at the Confederation of British Industry, Council Chamber, 21 Tothill Street, London, SW1, on Tuesday 2nd March 1971 at 12 noon.

1 To receive and consider the statement of accounts and the reports of the Directors and Auditors thereon and to declare a dividend.

2 To elect Directors.

3 To authorise the Directors to fix the remuneration of the Auditors.

4 To transact any other business that may be transacted at an Annual General Meeting.

By order of the Board
C. A. B. Leslie
Secretary

Notes

1 Only holders of Ordinary shares are entitled to attend or be represented at the meeting. A member entitled to attend and vote may appoint one or more proxies to attend and vote instead of him. A proxy need not be a member.

2 A statement has been drawn up for the period of 12 months to 8th January 1971 of all transactions of each Director, and so far as he can reasonably ascertain of his family interests, in the equity share capital of the Company and any of its subsidiaries. It will be available for inspection at the Registered Office of the Company, Hammersmith House, London, W6, during usual business hours (Saturdays and public holidays excluded) from the date of this Notice until 2nd March 1971 and at the Confederation of British Industry, Council Chamber, for a period of 15 minutes prior to and during the Annual General Meeting.

3 Warrants will be posted on 5th March if the proposed dividend is approved.

Registered Office:
Hammersmith House
London W6
5th February 1971

A Proxy Card incorporating this Notice is enclosed for holders of Ordinary shares

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4 CX-4-E ...ECTORS AND EXECUTIVE MANAGEMENT

The British Oxygen Company Limited

Board of Directors

Chairman	J. S. Hutchison
Vice Chairman	Sir Geoffrey Eley, CBE
	Sir Duncan Anderson, KBE, TD
	Sir John Cowley, KBE, CB, AM
	J. L. Hardie
	Sir Owen Wansbrough-Jones, KBE, CB
Group Managing Director	L. E. Smith
Managing Directors	R. C. Hesketh-Jones
	P. Laister
	J. M. Williams

Chief Executives

Trading Divisions	
Advanced Engineering	A. I. A. Ray
Chemicals	D. R. Scarffe
Food Services	D. W. E. Stafferton
Gases	D. W. N. Pitts
Metals	G. Winfield
Welding Products	N. F. J. Reckitt
Corporate Divisions	
Central Finance	R. B. Sims
Company Secretary	C. A. B. Leslie
European Co-ordinator	D. Melvin
Management Services	B. W. Mills
Personnel	J. H. Walwyn, CB, OBE
Public Relations & Marketing Services	A. Eden-Green

Auditors

Cooper Brothers & Co.

Chairmen and Managing Directors of principal Group companies outside Europe

Australasia			
	THE COMMONWEALTH INDUSTRIAL GASES LTD	*Chairman*	K. O. Humphreys
		Managing Director	J. A. Davidson
	NEW ZEALAND INDUSTRIAL GASES LTD	*Chairman*	T. G. Hall
		Managing Director	E. D. Edmundson
Africa			
	AFRICAN OXYGEN LTD	*Chairman*	I. Mackenzie
		Group Managing Director	J. B. Sutherland
	EAST AFRICAN OXYGEN LTD	*Chairman*	I. S. Edsie
		Managing Director	R. J. M. Muller
	RHODESIA OXYGEN (PVT) LTD	*Chairman*	G. C. V. Coppen
		Director/General Manager	P. B. Thorne
	ZAMBIA OXYGEN LTD	*Chairman*	J. W. Mills, CBE
		Director/General Manager	D. J. Woodworth
Asia			
	CEYLON OXYGEN LTD	*Chairman*	D. E. Martenz
		Director/General Manager	G. Wilby
	BRITISH OXYGEN (HONG KONG) LTD	*Chairman*	J. D. Clague, CBE, MC, TD
		Managing Director	R. Beynon
	INDIAN OXYGEN LTD	*Chairman*	N. Dandeker
		Managing Directors	A. K. Sen
			K. Hartley
	MALAYAN OXYGEN SDN BERHAD and SINGAPORE OXYGEN PTE LTD	*Chairman and Managing Director*	C. J. Boyles
	PAKISTAN OXYGEN LTD	*Chairman*	H. I. Vahimtoola
		Managing Director	P. J. R. Southgate
North America			
	CANADIAN OXYGEN LTD	*Chairman*	H. M. Turner
		President	J. A. Perham

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CHAIRMAN'S STATEMENT

Profits and Reserves

The greater part of the £4·6 million improvement in trading profits last year came from the UK Trading Divisions which began to harvest benefits from the plans set in motion in earlier years. The substantial advance in overseas earnings was in line with the experience of recent years. After payment of dividends, the capital and revenue reserves of the Group are increased by £2,578,000, of which £1,940,000 is retained profit of the year.

The higher profits and the potential evident for further improvement have enabled the Directors to recommend a dividend on the ordinary share capital of 12% as compared with 11% a year ago. The final payment of 9% this year adds to the disparity with the interim rate of 3% and the Directors intend in June 1971 to consider increasing the interim rate to achieve a better balance between the payments. Such action would not imply anything about the total dividend they might be likely to recommend for the full year.

Capital investment has again been substantial and orders placed at 30th September 1970 amounted to £14 million, with further expenditure authorised by the Board but not yet contracted amounting to £13 million. Most of this investment is needed for major additions to our UK production capacity to meet large new contracts with the British Steel Corporation and other users of industrial gases; for our big new gas production centre at Widnes with its modern satellite stations and for the special equipment for finally distributing the products after the initial rail transportation. Several of these new plants are now at the proving stage or moving into regular production, and it is probable that, with the addition of certain specific tonnage oxygen plants recently ordered and mentioned below, the enlarged production capacity coming into use will meet industrial needs well into the 1970s without major additions. Capital investment in the next few years therefore may be at a rather lower level than in the immediate past and capable of being met to an increasing extent from our cash flow which is now about £17 million.

Tonnage contracts were secured recently for large supplies of oxygen to the British Steel Corporation at Scunthorpe and Middlesbrough and will involve capital expenditure of over £9·5 million, which is being financed by our recent placing of £10 million of Tonnage Debentures.

The proceeds of these Tonnage Debentures, along with term loans for varying periods of years and the accommodation provided by our bankers, leave us well-equipped financially for our present needs and suitably placed to meet any new and unexpected requirement or unforeseen developments.

The Directors have been advised that the existing principal and supplemental Trust Deeds securing our Debenture Stocks (other than Tonnage Debenture Stocks) have become out of line with modern practice and attention is accordingly being given to revising and consolidating the Deeds. Debenture Stockholders' approval for this will be sought in due course. The way would then be open, if that seemed advisable, to fund some further portion of our bank borrowings or short-term indebtedness.

UK Trading

Taken as a whole, the return earned on our UK trading capital showed a welcome improvement during 1969/70, though still remaining well below the comparable earnings overseas. We expect the improvement to continue at home, where we believe we are now well-placed to exploit a number of profitable opportunities and growth areas.

The improvement in UK trading was led by Gases Division, despite the heavy, but necessary, preoccupation of its top management throughout the year with the construction and settling-in of several new and large production plants and the large-scale replanning of working arrangements to suit the new situation. The Division looks forward keenly to reaping the benefit of this and particularly to the opportunities that will arise from operation of the major new centre of national production at Widnes and its revolutionary pattern of distribution.

In other Divisions the improvement under various headings projected a year ago was achieved and UK profits benefited accordingly. There should be further such advances in 1970/71 as well as benefits from the upward trends in turnover and earnings resulting from earlier planning for expansion.

The processes of integration and management change and of rationalisation of newly-acquired businesses with existing activities take time and

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patience and sometimes give rise to unforeseen difficulties; but progress with the integration of our earlier acquisitions has been good and contributed to last year's results: there should be more to come in 1970/71. More recent acquisitions will make immediate contributions from their present profits but will require time to become fully interwoven into our structure and to yield the improvement in profitability that is anticipated.

Overseas

The growth in the profits of our overseas companies was brought about very largely by the continuing effort and skilled application of the overseas Managing Directors and their management teams guided and encouraged by their local Chairmen and Boards. Considerable political and economic change and development occurred last year in the countries in which they operate, and we appreciate all the more their achievements and congratulate all concerned on so favourable an outcome.

In previous years I have made repeated pleas for a more understanding and encouraging treatment of companies operating internationally which make significant contributions both to the welfare and economic progress of the countries concerned as well as to the British economy and to our political influence abroad. I have been encouraged to note that the present government has already commenced to re-examine some of the effort on the periphery of our export drive and we must hope that modification of the burden of taxation on overseas investment may receive consideration in the general review of taxation now being undertaken.

The profit income from our own manufacturing companies overseas is now £5 million per annum after tax and we have substantial further benefit in the export selling of UK manufactures through them. Indeed, between one-fifth and one-quarter of British exports are estimated to be made in this way through overseas affiliates of British firms.

New and realistic policies should surely take account of the influence in international affairs to be obtained if conditions for British investment abroad are freed from present handicaps so that industrialists can once more have the opportunity vigorously to build up and expand Britain's overseas investments in a world that is increasingly international in outlook.

Management

This year's considerable improvement in profits undoubtedly owes much to direction and sound basic planning of Mr. L. E. Smith, Group Managing Director, Mr. J. M. Williams in charge of Gases Division and associated developments, Mr. F. Laister handling the other Trading Divisions, and Mr. R. C. Hesketh-Jones in charge of overseas affairs. They have had splendid co-operation throughout—and a lot of hard and excellent work—from the increased number of Chief Executives in charge of the trading and service divisions and their top management teams. I thank them all sincerely for their resolute and successful effort, as I also thank the many in the organisation at all levels who by their good work and support made so much advance possible last year.

Prospects

Our UK Trading Divisions all have their specific and confident plans for trading advance and for development in 1970/71: we can look forward again to their greater contribution to total results.

Our overseas companies, too, are confident and are forging ahead, but whilst expecting further growth, it would be unrealistic in today's more difficult conditions, to look for its continuance at quite the rate which doubled overseas profits over the last four years.

Of course, the whole may be upset by the present inflationary and disturbed scene not only in the UK but in almost all the countries in which we operate. This apart, and given any reasonable run, 1970/71 should be another good year for us.

J. S. Hutchison

London
5th February 1971

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REPORT OF THE DIRECTORS

The Directors submit their report and statement of accounts for the year ended 30th September 1970.

The consolidated profit and loss account is summarised thus:

		£'000
Trading profit after tax attributable to parent Company		7,704
Exceptional profits, less losses, after tax		350
Group profit available for distribution		8,054
Dividends already paid:		
Preference	122	
Ordinary interim of 3%	1,498	
		1,620
Directors recommend:		
Final ordinary dividend of 9%	4,494	
Profit retained	1,940	
		6,434
		8,054

The main features of the year's activities are reported below under the divisional and company headings used in the Group:

Gases Division

Demand for the products of the Gases Division increased again despite the general problems of the economy and particularly of the engineering industries. This gratifying result owes much to successful efforts by the Division to develop the total market for industrial gases through employment of a wide range of process specialists with expertise in the technologies of the industries BOC supplies.

A major new liquid oxygen/nitrogen production plant at Widnes, Lancashire, has been under construction during the year and is now at the proving stage. Construction of this very large plant, with a capacity of more than 500,000 tons of product per annum, and the organisation and equipment of its associated distribution system, has absorbed much management attention during the year. This total manufacturing/distribution system will require time to reach full operation; it is confidently expected however that substantial benefits will accrue by the end of the current financial year. The ability under this system to move quickly by rail and road large quantities of product to support major short-term demands is expected to be of substantial benefit to customers and to enable prompt response to be made to the large and often unexpected demands which have become a recurrent feature of today's industrial scene; the first rail/road transport centres will be at Sheffield, Wolverhampton and Wembley.

Long-term contracts for further large supplies of oxygen to the British Steel Corporation at Middlesbrough and at Scunthorpe, and for the supply of nitrogen to Pilkington Brothers Limited at St. Helens were negotiated during the year. These increased supplies of oxygen to British Steel Corporation will, we are sure, play a major part in the expansion and modernisation of the country's steel industry.

The advantages gained by substantial additional investment in larger and more economical plants, vehicles and equipment, and significant further advance in the development of our production and distribution systems have been to some extent offset by an accelerating pressure from external cost increases from every source. Major managerial effort has been and will continue to be expended in minimising the effect of this multiplicity of increases both on our customers and on the

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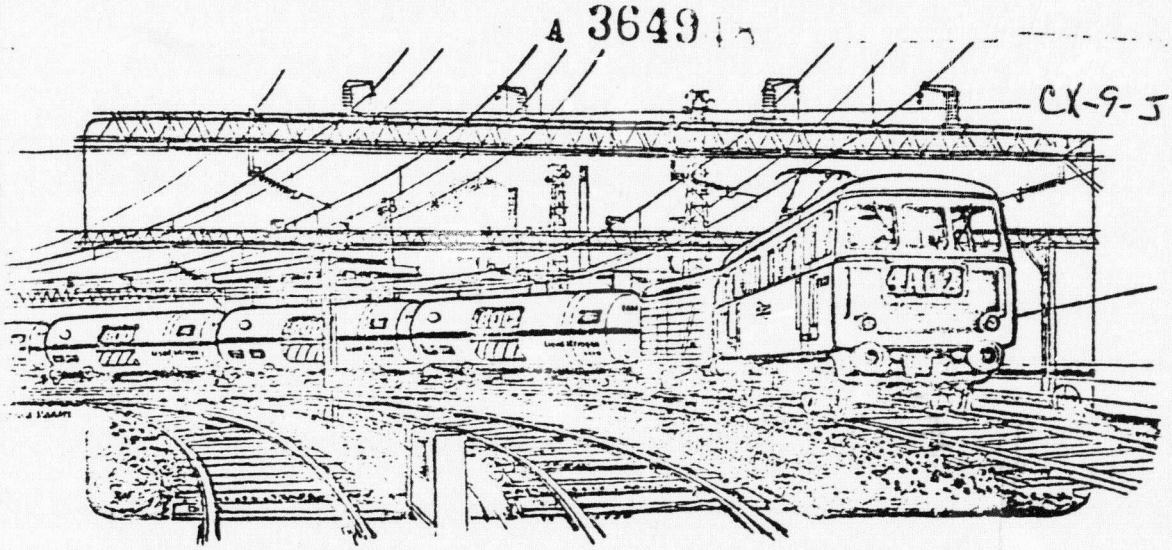


BOC cryogenic trains, the first of their kind in the UK, take liquid gas from BOC's new 1600 ton per day plant at Widnes, Lancs to various redistribution depots. From these the product is taken by road tanker to customers.

Company, and the important changes now to come in our operating procedures should help.

The medical and special gas businesses continued to make steady progress. In addition, a new Fuel Gas Services department was formed last year which specialises in the provision of transport and contracting services to the fuel industry.

Seaflame Limited is now fully engaged on both industrial and domestic conversion work in the London area associated with the North Sea gas programme.

In Ireland, arrangements were completed for the reorganisation of the industrial gas business. As a result, BOC now has a majority holding in Irish Industrial Gases Limited which operates from Dublin, while Hammond Lane Foundry Company Limited has a share in BOC's industrial gas activity in Northern Ireland.

Welding Products Division

Expanded sales and profits were again achieved by this Division, particularly in the field of equipment for arc and gas welding and cutting processes, despite increased competition. This further progress results from our advanced position and the accent put on user safety and improved service. In addition, our wide range of products enables us to offer a total capability in both equipment and consumables for the processes in this field.

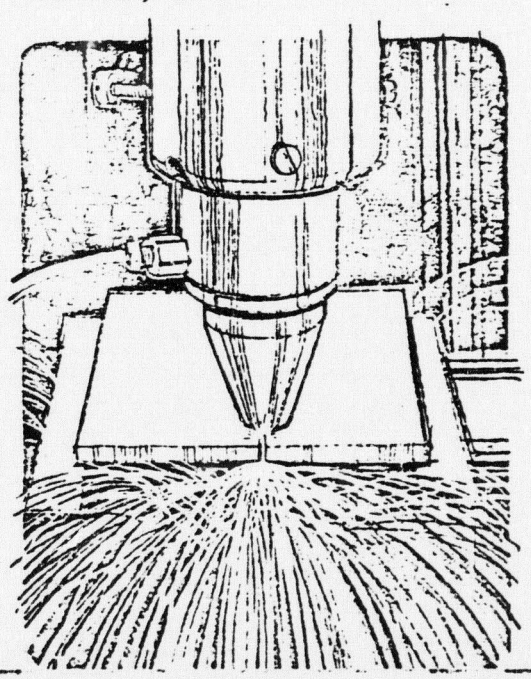
During the year, the availability of our range has been much improved by bringing the products nearer to the customer. In the UK this has been achieved in a variety of ways, including opening a number of local merchandising centres and a strengthening of our distribution network. Progress is also being made in continental Europe where we have recently agreed terms for acquiring a majority share interest in a welding products business in Holland.

Exports of all welding products reached a record level and have now expanded by 50% over the last two years. A notable new product success was a first sale of a mill to Brazil for the production of spirally welded pipe, for the building of piling for the Niteroi bridge.

In the rapidly growing semi-automatic arc welding field progress has been good with sales of Autolynx, introduced at the end of last year, going well in home and overseas markets, including USA.

Our position in gas cutting machines has been further improved in this country and has also

BOC have developed the first industrial laser cutting machine in the UK. Its great advantage is the extreme accuracy of its cut. It can be used on almost any material.



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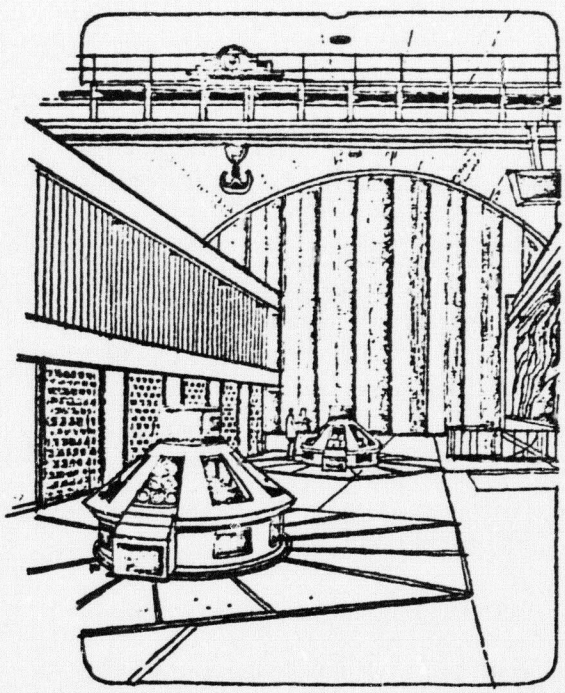
panded in markets overseas. The coming year will see several interesting new product developments in the range of equipment offered, particularly in cutting machines and semi-automatic welding equipment.

Our advanced technical work in high energy sources such as electron beam and laser techniques continues and progress has also been made in the technology of underwater welding.

Chemicals Division

Odda Smelteverk A/S, Norway

Odda again operated at full capacity for carbide and its derivatives; but the year was marked by sharply rising costs due to major increases in prices of coke and steel (for drums), both imported from UK. Additionally, the October Norwegian budget doubled the levy on the hydro-electric power on which the site depends and increased substantially payments for social benefits. The result will inevitably be reflected in price increases.



Odda Smelteverk, BOC's carbide manufacturing subsidiary in Norway, shares in the 200,000 kilowatt hydro-electric scheme at Tyssedal. This is the main hall of the recently-built power station which has been carved out of the heart of the mountain.

British Oxygen Maydown Limited, Northern Ireland

Output of acetylene from the Wulff plant increased substantially. Following greatly improved operating performance on Wulff, production of acetylene from carbide ceased in June and the Wulff plant has been a satisfactory single source of product supply to our customer since that time. Ethylene dichloride production also increased but was still below requirements. Intensive management effort continues and the position is expected to improve further in 1970/71.

British Oxygen Chemicals Limited, Chester-le-Street

Demand for all products has been substantially better than in the previous year and with the successful commissioning of the rebuilt tall oil plant in September following the major fire early in the year, we expect 1970/71 to be materially better than 1969/70. Further investment of more than £1 million is now to proceed to double tall oil refining capacity and raw materials for the additional production have already been secured.

Metals Division

Significant advance during the year was aided by firm markets for ferro alloys and generally buoyant conditions for refractory metals, inorganic chemicals and hard metal products. Murex profits went ahead well and High Speed Steel Alloys Limited had a good first year as a member of the Division.

Management restructuring and strengthening proceeded satisfactorily and encouraging progress was made in the development and implementation of plans to diversify the Division's markets, using existing technical expertise.

The water tower at Murex, Rainham, has become a landmark on the Thames. This Metals division plant produces a wide range of refractory metals.

[illegible]w weeks ago we were able to announce the acquisition of the whole share capital of Deloro Stellite Limited of Belleville, Canada, along with its subsidiary Deloro Stellite (UK) Limited of Swindon, England, and its small associated companies in Koblenz, West Germany, and Trollhatten, Sweden. The purchase price of $C14 million has been financed by five-year loans from American banks.

Stellite is a hard-surfacing cobalt alloy and Deloro products in the hardness range fit conveniently between the high alloy steels and the tungsten-carbide sintered metals already produced by our Metals Division. Deloro also makes precision hard

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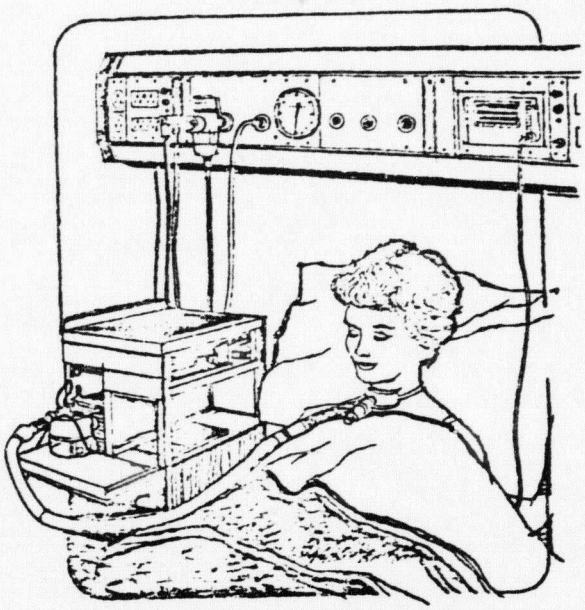


Many clinical services are combined in this new bedhead unit designed by BOC for hospital use.

alloy castings, a proportion of which find medical use as surgical implants, affording an interesting addition to our medical equipment business.

Rationalisation of the Division's activity in the metallurgical field continues and will now embrace Deloro activities; further benefits are expected during the coming year.

Advanced Engineering Division

An encouraging improvement has been made in our Advanced Engineering activities. All aspects of our Medical and Aviation equipment manufacture in the UK are now centralised in enlarged premises at Harlow, giving greater efficiency and service to customers. The new financial year opened with a high level of orders.

In Europe, our medical equipment sales have been running at a record level and manufacture in Italy is profitably established.

Edwards High Vacuum, now fully integrated within this Division, has had an improved year and enters 1971 with a heavy order book.

During the year, our specialised manufacture of helium and hydrogen refrigerators, operating at very low temperatures, was separated from the manufacturing of the more routine cryogenic vessels and the latter activity reduced in scale to match a contracting demand.

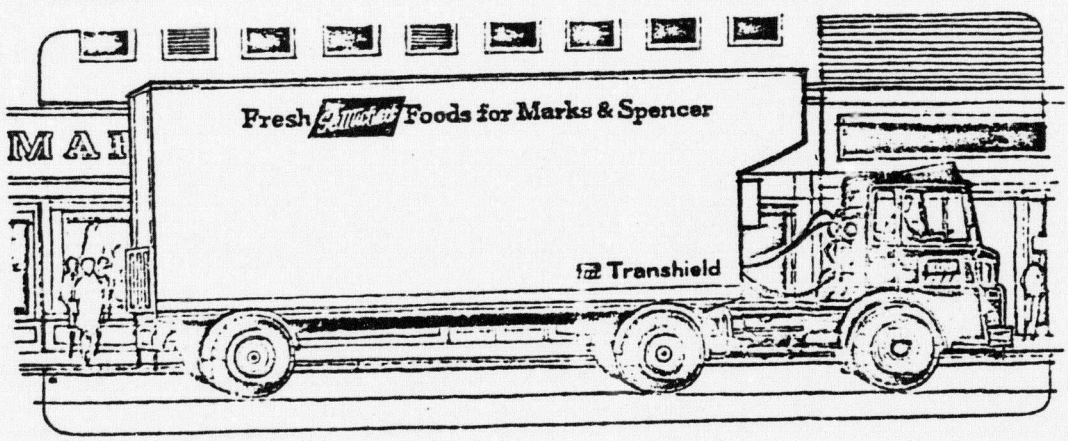
Export orders for Advanced Engineering products continue to rise and now represent half the turnover of the Division.

Food Services Division

During 1969/70, the businesses acquired in the previous year were co-ordinated and strengthened. A trading pattern within key areas has been established which will allow a proper balance between rapid growth and the profits which we expect in this field.

A new company, BOC Transhield Limited, was set up to absorb the food distribution activity of Bain & Hodge and to operate a large-scale integrated food delivery service for Marks & Spencer Limited. Further depots, in the north and in the south-west of England, adding substantially to existing resources in Lancashire and in Kent, will come into service shortly and will form part of a very high quality, purpose-designed system. Ace Refrigeration and J. Muirhead both gained considerably from the rapid growth in the sale of frozen foods in the United Kingdom market. Batchelors (Ireland) are successfully withstanding the high rate of inflation which has affected Eire recently. By rearranging their marketing, produc-

Soon BOC Transhield vehicles will be seen in the High Street. A large-scale food delivery service has been planned for Marks & Spencer.



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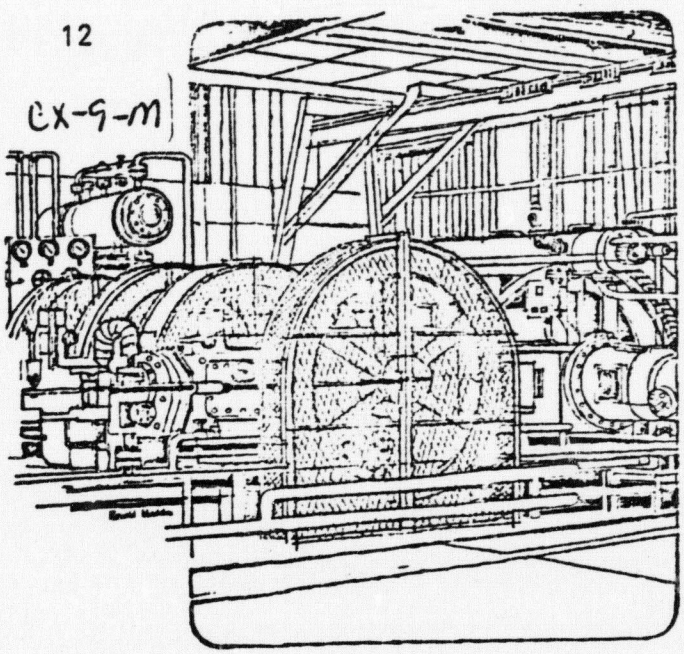
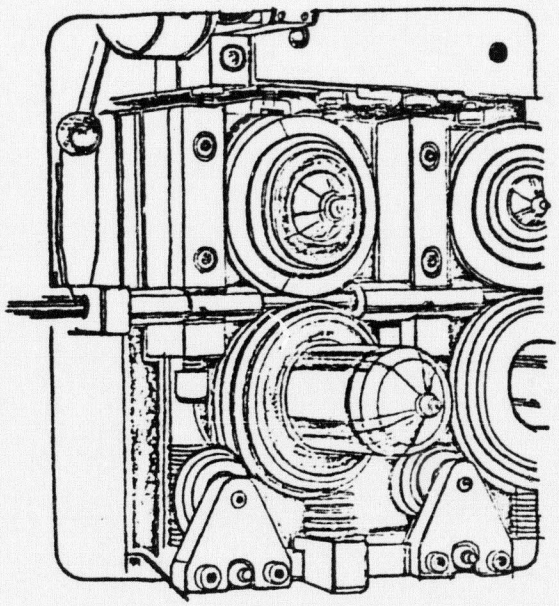


Expansion engine at CIG's $A 2 million Kwinana gas complex, Western Australia, supplying nitrogen, hydrogen and carbon dioxide to the Western Mining Corporation's nickel refinery.

Canadian Oxygen recently acquired the welding and gas business of Air Reduction Canada. This machine, used in electrode manufacture, de-scales, straightens and draws steel rod at the rate of 1,000 feet a minute.



tion and distribution set-ups they have achieved considerable improvements in efficiency and strengthened their position in the market. Their profit should benefit.

Sparklets in the UK and Heimsyphon in West Germany have been undergoing both development and rationalisation which we believe will further improve their future.

In the coming year we expect continued growth in the food services field from both existing and new activities based on our technical skills.

Europe

Western Europe is now regarded by BOC as an extension of the UK markets served by the Home trading divisions. Possibilities for new investment are being actively explored and in order to co-ordinate and monitor these activities, a European Co-ordination Office has been set up at Group headquarters.

Overseas

Profit contribution from overseas operations outside Europe improved by £2 million, reflecting generally favourable trading conditions and close management attention to profitability.

In Australia, Commonwealth Industrial Gases improved its position and profits. A tender for a ten-year contract for the supply of gases to the new steel plant at Westernport was successful. Other developments included the establishment of a joint venture with local minority partners in Thailand.

In South Africa, substantial new gas production plant was brought on stream and plans finalised for a new electrode factory at Brits. Economic activity during the year was slower than hitherto but despite this and the greatly increased competition, African Oxygen made good progress.

Indian Oxygen had improved results from increased business activity generally and in spite of severe labour difficulties in West Bengal.

In Pakistan, the trend of improvement noted last year continued. Our factories in the Eastern zone escaped direct damage in the recent cyclone disaster.

In Singapore vigorous growth, largely based on the steel and semi-conductor industries, was responsible for a record year. Prospects are encouraging and to a lesser—but still substantial—extent, results in Malaysia also improved.

In Canada the welding and gas business of Air Reduction Canada was acquired towards the end of the financial year. The purchase was financed by bank loans for a term of years in London and Toronto. This acquisition gives Canox considerable expansion and adds carbon dioxide and a wide

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range of cutting and welding equipment to their activity. Canox results were satisfactory and progressive last year despite a general slowing down in the economy in Canada.

1970 was the first full year in which we were represented in Japan, negotiations being concluded between Edwards High Vacuum and Japan Oxygen for the establishment of a joint manufacturing company. It is hoped to increase connections in this valuable market.

Development and Research

A major part of our expenditure on development and research continues to be incurred by the UK trading divisions and by our overseas companies in direct support and extension of their product lines. Additionally, however, our smaller multidisciplinary central activity at Morden has been active in research in a number of fields of interest to the Group. For instance, the continuing effort of our Superconducting Magnet System team has resulted in a contract to supply a large superconducting quadrupole magnet system for particle beam handling in the Rutherford Laboratories. It is believed that this is the first order of its kind in the UK to a commercial supplier.

Also, our Cryogenic Refrigerator Systems group, which operates within the framework of our central development and research effort, has gained a contract to build a large helium refrigerator for Culham Laboratories for their advanced magnetically suspended Levitron ring required to study plasma in fusion research.

BOC-Airco

BOC-Airco Cryogenic Plant has maintained a high level of activity through the year, both in its workshops at Edmonton and on work in the field. Major plants at Widnes and Middlesbrough were successfully commissioned after the end of the financial year.

Also, during the year further orders were received for tonnage oxygen plants from BOC Gases Division to support tonnage supply contracts to the British Steel Corporation, and also from USA for tonnage oxygen plants for United States Steel.

Airco-BOC, the twin company operating in USA, completed work on a 600-tpd plant in Texas and obtained orders for three natural gas liquefaction plants. These LNG plant orders follow the plant built last year for San Diego Gas & Electric Company, now being commissioned.

Personnel

Much managerial attention has been directed both by the trading divisions and at the centre to schemes to advance the effectiveness of our use of manpower and this effort has met with success. In the course

Welding a natural gas pipeline running from Auckland to Wellington. New Zealand Industrial Gases supplied the electrodes.

The booming semi-conductor industry in Singapore depends on Singapore Oxygen for large quantities of nitrogen (for its inertness) and hydrogen (for cutting).

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of the year, also, we decided to double the capacity of our residential management college at Chartridge in Buckinghamshire which has well proved its worth in the ten years during which we have run in-house residential managerial training programmes. Considerable improvement in management performance can be obtained from well-directed efforts in this field.

Directors and Auditors

The Directors are named on page 4. The Directors retiring by rotation are Sir Geoffrey Eley, CBE and Sir Duncan Anderson, KBE, TD, who are willing to be reappointed.

The Auditors, Cooper Brothers & Co, continue in office in accordance with Section 159(2) of the Companies Act 1948.

Directors' interests

The Register kept by the Company for the purpose of Section 27 of the Companies Act 1967 shows that the number of Ordinary shares and amounts of Stock of the Company in which the Directors of the Company and their families had an interest as at 30th September 1969 and 30th September 1970 were as follows:

DIRECTOR	CLASS OF SHARES/STOCK	NUMBER OF SHARES/VALUE OF STOCK	
		30/9/70	30/9/69
Mr. J. S. Hutchison	Ordinary	55,000	*55,000*
As Trustee	Ordinary	25,000	*25,000*
As Trustee	5¾% Debenture	£5,275	*£5,275*
As Trustee	6¾% Debenture	£13,950	*£13,950*
Sir Geoffrey Eley	Ordinary	15,595	*15,595*
As Trustee	Ordinary	20,784	*8,324*
As Trustee	7½% Convertible Unsecured Loan	—	*£5,430*
Sir Duncan Anderson	Ordinary	10,000	*10,000*
Sir John Cowley	Ordinary	4,475	*4,475*
Mr. J. L. Hardie	Ordinary	35,500	*35,500*
As Trustee	Ordinary	28,900	*35,000*
As Trustee	5¾% Debenture	£5,275	*£5,275*
As Trustee	6¾% Debenture	£14,690	*£14,690*
Sir Owen Wansbrough-Jones	Ordinary	5,280	*5,280*
Mr. L. E. Smith	Ordinary	1,000	*500*
	Ordinary (5% paid)	55,000	—
Mr. P. Laister	Ordinary	1,000	*500*
	Ordinary (5% paid)	45,000	—
Mr. J. M. Williams	Ordinary	2,000	*2,000*
	Ordinary (5% paid)	45,000	—
Mr. R. C. Hesketh-Jones	Ordinary	4,251	*1,501*
	Ordinary (5% paid)	45,000	—

No Director has a beneficial interest in any shares or debentures of any subsidiary company.
The interests of the Directors and their families, in aggregate, do not exceed 5% of the share capital or votes of the Company or of any subsidiary.
No Director has a service contract which does not expire, or which is not determinable by the Company without payment of compensation, within one year.
The partly paid shares referred to above were issued under the Share Incentive Scheme mentioned on page 15.

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Interests in Company's share capital

So far as can be ascertained no one person or corporation holds or is beneficially interested in any substantial part of the share capital of the Company.

Share and loan capital

During the year the following new issues were made:

9,463,486 Ordinary shares of 5s. each as a result of conversion of £4,401,621 7½% Convertible Unsecured Loan Stock 1987/92 by stockholders in accordance with the terms and conditions of the Trust Deed constituting the Stock.

224,818 Ordinary shares of 5s. each for the acquisition of a 10% interest in Hirst Electronic (Holdings) Limited.

795,000 Ordinary shares of 5s. each 5% paid under the terms of the Share Incentive Scheme approved in July 1970 by the Company in General Meeting.

72,813 Ordinary shares of 5s. each for the acquisition of the Ordinary share capital of Prochem Ltd.

Charitable and political contributions

During the year ended 30th September 1970 Group companies in the United Kingdom made charitable and educational payments totalling £28,854.
In accordance with long established practice no political contributions were made by the group in the UK.

Exports

The value of goods exported by the group from the United Kingdom was as follows:	£'000
to BOC companies	2,441
to others	11,722
	14,163

Profits earned from overseas investment, after allowing for local taxation and the interests of minority shareholders, totalled £5,069,223 for the year.

Employees in the UK

Average number employed:	19,440
Aggregate remuneration:	£28,642,000

By order of the Board
C. A. B. Leslie
Secretary

London
5th February 1971

REPORT OF THE AUDITORS

To the Members of The British Oxygen Company Limited

In our opinion, based on our examination and the reports of the auditors of certain subsidiaries not audited by us, the accounts set out on pages 16 to 25 together give a true and fair view of the state of affairs at 30th September 1970 and of the profit for the year ended on that date and comply with the Companies Acts 1948 and 1967.

Cooper Brothers & Co.
Chartered Accountants

London
5th February 1971

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16 CONSOLIDATED PROFIT AND LOSS ACCOUNT

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The British Oxygen Company Limited and subsidiary companies

	1970	*1969*
	£'000	*£'000*
Sales *note 9, page 18*	207,858	*161,251*
Trading profit *note 10, page 19*		
United Kingdom and Europe	12,420	*9,823*
Overseas	14,115	*12,133*
	26,535	*21,956*
Less development and research *note 5, page 18*	2,589	*2,639*
	23,946	*19,317*
Less interest paid *note 11, page 19*	5,431	*4,236*
	18,515	*15,081*
Less taxation *note 12, page 19*	8,548	*7,229*
	9,967	*7,852*
Less attributable to minority shareholders	2,263	*1,906*
Trading profit after tax attributable to parent company *note 6, page 18*	7,704	*5,946*
Exceptional profits less losses after tax adjustments *note 15, page 20*	350	*815*
Available for disposal *note 16, page 20*	8,054	*6,761*
Dividends:		
Preference	122	*122*
Ordinary: interim 3%	1,498	*1,425*
proposed final 9% (1969 8%)	4,494	*3,798*
	6,114	*5,345*
Retained profit	1,940	*1,416*
	8,054	*6,761*

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BALANCE SHEETS 30th SEPTEMBER 1970

The British Oxygen Company Limited and subsidiary companies

PARENT 1970 £'000	PARENT *1969 £'000*		GROUP 1970 £'000	GROUP *1969 £'000*
60,839	*55,435*	Fixed assets *note 1, page 18 and note 17, page 21*	128,929	*113,764*
61,309	*54,453*	Subsidiary companies *note 18, page 22*	—	—
(432)	*858*	Investments *note 19, page 22*	1,681	*2,803*
35,054	*34,514*	Current assets *note 20, page 23*	122,096	*108,693*
156,770	*145,260*		252,706	*225,260*
19,945	*14,893*	*Less* current liabilities and provisions (excluding bank borrowings) *note 21, page 23*	52,583	*43,465*
136,825	*130,367*		200,123	*181,795*
		Financed by:		
49,929	*47,479*	Issued ordinary shares of BOC *note 23, page 24*	49,929	*47,479*
7,082	*5,046*	Share premium	7,082	*5,046*
13,058	*13,748*	Reserves *note 24, page 24*	32,584	*30,006*
70,069	*66,273*	Ordinary shareholders' interests	89,595	*82,531*
2,500	*2,500*	Issued preference stock of BOC *note 23, page 24*	2,500	*2,500*
—	—	Minority shareholders' interests	18,729	*16,503*
72,569	*68,773*		110,824	*101,534*
32,693	*37,400*	Loans *note 22, page 23*	48,489	*48,595*
5,885	*6,697*	Deferred taxation *note 4, page 18*	8,391	*8,466*
25,678	*17,497*	Bank borrowings (group—£1,000,000 secured)	32,419	*23,200*
136,825	*130,367*		200,123	*181,795*

J. S. Hutchison *Director*

L. E. Smith *Director*

18 NOTES ON ACCOUNTS

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ACCOUNTING PRINCIPLES

1 Fixed assets

(a) United Kingdom investment grants receivable are deducted from the cost of the asset.
(b) Depreciation is calculated to write off the assets (other than certain tonnage plants) during their expected normal lives by equal annual instalments (the straight line method) at rates ranging from 2½% to 25% per annum depending upon the type of asset. Depreciation on tonnage plants commissioned since 1st October 1969 is calculated on an annuity basis.
(c) Specific provision is not made for the replacement of fixed assets but, in the opinion of the directors, profits retained and borrowing facilities available are adequate for this purpose.

2 Stock and work-in-progress

Stock and work-in-progress is valued at cost or net realisable value whichever is lower, and cost where appropriate includes a proportion of overhead expenses. Profits are not taken on construction contracts until completion but provisions are made for all known or anticipated losses.

3 Debtors

Known bad debts are written off and specific provision is made for any considered to be doubtful of collection. In addition, general provisions of 1% to 2½% are made on the balance of sales ledger debts.

4 Deferred taxation

This represents corporation tax at current rates on the amount by which accumulated taxation capital allowances on plant and equipment exceeds provisions made in the accounts of the Group for depreciation and is reduced by expenditure not deductible for tax purposes until later years.

5 Development and research expenditure

Group expenditure (which comprises the costs of operating the development and research centres, United Kingdom and Overseas, inclusive of appropriate overheads) is written off when incurred.

6 Trading profit

It is policy to arrive at trading profit reflecting normal trading conditions and to show separately:
(a) exceptional profits and losses arising during the year,
(b) tax provisions and other items not relating to the current year and
(c) capital profits and losses.

7 Investments

Only dividends received, or declared and receivable, are included in trading profit.

8 Exchange rates

All currency figures are converted at the rates of exchange ruling at the financial year end.

9 Sales

Sales are based on invoiced value excluding inter-company sales.

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CONSOLIDATED PROFIT AND LOSS ACCOUNT DETAILS

	1970 £'000	1969 £'000
10 Trading profit shown is after charging:		
Depreciation—United Kingdom and Europe	7,987	7,260
Overseas	4,776	4,436
	12,763	11,696
Pension and provident funds contributions	2,404	1,895
Audit fees (parent company £33,000)	203	151
Emoluments of directors of parent company		
As directors	7	7
For management *note 13, page 20*	121	88
Payments to past directors and dependants of past directors of parent company	22	24
	15,520	13,861
and after crediting:		
Investment income—unquoted	288	216
11 Interest paid		
Bank loans, overdrafts and other loans repayable within five years	2,050	1,168
All other loans	3,381	3,068
	5,431	4,236
12 Taxation on profit of year		
United Kingdom—corporation tax at 42½% (1969 45%)	3,911	3,256
deferred taxation	429	566
	4,340	3,822
Reduced by—double tax relief	1,818	1,955
overspill relief	23	107
	2,499	1,760
Overseas—taxes	5,428	5,179
deferred taxation	621	290
	8,548	7,229

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13 Directors' emoluments

	1970 £'000	*1969* *£'000*
Chairman	15	*15*
Highest paid director	22	*19*
	Number	*Number*
Up to £2,500	4	*5*
£5,001 to £7,500	—	*2*
£7,501 to £10,000	1	*3*
£15,001 to £17,500	4	*1*
£17,501 to £20,000	—	*1*
£20,001 to £22,500	1	—

The figures for 1969 include remuneration (for management) of directors who had served for less than the full financial year.

14 Senior employees' emoluments

	Number 4	*Number* —
£10,001 to £12,500		

15 Exceptional profits less losses after tax adjustments

		£'000
Profit on sale of fixed assets		1,811
Tax adjustments from previous years		666
		2,477
Less:		
Costs of rationalising and reorganising production and other facilities	684	
Accelerated depreciation of plant no longer fully remunerative	731	
Exceptional costs of commissioning new plants	227	
Other items	485	
		2,127
		350

16 Dividends from overseas subsidiaries

The unappropriated profits of overseas subsidiary companies are liable to overseas and United Kingdom taxation if distributed as dividends. There are exchange control restrictions in certain overseas countries on the remittance of funds to the United Kingdom.

BALANCE SHEET DETAILS

17 Fixed assets

GROUP	TOTAL	FREEHOLD AND LEASEHOLD PROPERTIES	PLANT AND MACHINERY	CYLINDERS	MOTOR VEHICLES	FURNITURE AND FIXTURES
	£'000	£'000	£'000	£'000	£'000	£'000
Cost or valuation 1/10/69	216,423	38,359	113,622	45,948	13,272	5,222
New subsidiaries	3,975	977	2,211	335	309	143
Capital expenditure	26,144	3,271	14,061	5,612	2,551	649
Revaluations	1,423	2,340	(227)	(690)	—	—
Demolitions and sales	(8,764)	(1,654)	(2,621)	(2,836)	(1,438)	(215)
Cost or valuation 30/9/70	239,201	43,293	127,046	48,369	14,694	5,799
Depreciation 1/10/69	102,659	10,813	57,410	25,117	5,961	3,358
New subsidiaries	656	64	362	83	106	41
Provided during year (see below)	14,034	1,018	8,148	2,676	1,725	467
Revaluations	(1,451)	(123)	(638)	(690)	—	—
Demolitions and sales	(5,626)	(558)	(1,307)	(2,573)	(1,005)	(183)
Depreciation 30/9/70	110,272	11,214	63,975	24,613	6,787	3,683
Net book value 30/9/70	128,929	32,079	63,071	23,756	7,907	2,116
PARENT						
Cost 1/10/69	106,551	13,856	63,867	19,654	7,219	1,955
Capital expenditure	13,993	712	9,018	2,808	1,183	272
Demolitions and sales	(6,582)	(203)	(2,884)	(2,799)	(575)	(121)
Cost 30/9/70	113,962	14,365	70,001	19,663	7,827	2,106
Depreciation 1/10/69	51,116	4,157	31,194	11,532	2,882	1,351
Provided during year	6,537	443	4,147	993	760	194
Demolitions and sales	(4,530)	(74)	(1,281)	(2,635)	(426)	(114)
Depreciation 30/9/70	53,123	4,526	34,060	9,890	3,216	1,431
Net book value 30/9/70	60,839	9,839	35,941	9,773	4,611	675

Group depreciation above (£14,034,000) includes £1,271,000 in respect of plant no longer fully remunerative shown as an exceptional loss (£731,000 net of tax) in *note* 15, *page* 20.

Ex-9-W

17 Fixed assets continued

	PARENT	GROUP
	£'000	£'000
Capital expenditure is after deducting UK investment grants	2,886	3,090

Three overseas companies revalued their fixed assets during the year ended 30th September 1970 which increased their net book values by approximately £2·9 million. Freehold and leasehold properties were valued by independent valuers, and plant, machinery and cylinders by the company, both being on a replacement value basis.

Five overseas companies revalued certain fixed assets in the years 1966-68, which increased their then net book values by £1·2 million approximately.

The net book value of leasehold properties at 30th September 1970 included above is:

	PARENT	GROUP
	£'000	£'000
Long term	2,913	5,275
Short term	896	1,674
	3,809	6,949

18 Subsidiary companies

	1970	*1969*
	£'000	*£'000*
Shares at cost and scrip issues at par, less amounts written off	33,409	*31,166*
Amounts owing to parent, including dividends since declared	31,806	*23,947*
	65,215	*55,013*
Less amounts owing by parent, less dividends since declared	3,906	*560*
	61,309	*54,453*

19 Investments

	PARENT		GROUP	
	1970	*1969*	1970	*1969*
	£'000	*£'000*	£'000	*£'000*
Shares at cost	931	*949*	2,334	*1,921*
Less amounts written off	109	*109*	140	*133*
	822	*840*	2,194	*1,788*
Add amounts owing to parent or group companies	1,023	*1,135*	1,981	*2,189*
	1,845	*1,975*	4,175	*3,978*
Less amounts owing by parent or group companies	2,277	*1,117*	2,494	*1,175*
	(432)	*858*	1,681	*2,803*
Quoted: market value £9,000	—	—	7	7
Unquoted: equity at directors' valuation	821	*839*	2,000	*1,793*
others at directors' valuation	1	*1*	97	*97*
	822	*840*	2,194	*1,897*

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	PARENT		GROUP	
	1970	1969	1970	1969
	£'000	£'000	£'000	£'000
20 Current assets				
Stock and work in progress *note 2, page 18*	11,427	10,235	57,246	49,337
Debtors and payments in advance *note 3, page 18*	19,547	15,269	57,097	51,[illegible]
Investment grants receivable	4,049	3,306	4,450	3,[illegible]
Tax reserve certificates	—	—	8	[illegible]
Deposits at short call	—	2,500	438	4,342
Cash and bank balances	31	122	2,857	2,5[illegible]
	35,054	34,514	122,096	108,[illegible]
21 Current liabilities and provisions (excluding bank borrowings)				
Creditors and accrued liabilities	13,871	10,241	40,172	32,554
Taxation—United Kingdom	1,390	582	2,959	1,939
Overseas	190	172	4,958	5,124
Proposed final ordinary dividend	4,494	3,798	4,494	3,798
	19,945	14,893	52,583	43,465
22 Loans				
5¼% Debenture stock 1981/86: secured	8,620	8,625	8,620	8,625
6¼% Debenture stock 1985/90: secured	6,700	7,000	6,700	7,000
8½% Tonnage Debenture stock 1988: secured	6,000	6,000	6,000	6,000
8½% Tonnage Debenture stock 1990: secured	7,500	7,500	7,500	7,500
7½% Convertible Unsecured loan stock 1987/92	1,373	5,775	1,373	5,775
7½% IRC loan 1976: unsecured	2,500	2,500	2,500	2,500
7% Debenture stock 1971: secured	—	—	308	308
7% Debenture stock 1974: secured	—	—	414	414
7¼% Debenture stock 1976: secured	—	—	545	545
7¼% Debenture stock 1983: secured	—	—	981	931
7½% Debenture stock 1975: secured	—	—	393	227
7½% Debenture stock 1981: secured	—	—	3,333	3,333
7¾% Debenture stock 1979: secured	—	—	803	589
7¾% Debenture stock 1984: secured	—	—	199	114
8¾% Debenture stock 1981/95: unsecured	—	—	3,538	1,5[illegible]
Other Debenture and Mortgage Loans:				
Repayable within 5 years: secured	—	—	1,138	[illegible]
unsecured	—	—	2,363	
Others: secured	—		1,434	
unsecured	—		347	
	32,693		43,189	

[illegible] debenture and mortgage loans are repayable over the years 1971 to 1999 and carry interest rates [illegible] between nil and 11%.

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23 Share capital

	AUTHORISED	ISSUED	
		1970	
	£'000	£'000	
Ordinary shares of 5/- (fully paid)	49,919	49,919	
Ordinary shares of 5/- (5% paid)	199	10	—
Shares of 5/-	7,382	—	—
	57,500	49,929	
6½% Cumulative preference stock	500	500	
5% Cumulative second preference stock	1,000	1,000	
4% Cumulative second preference stock	1,000	1,000	
	2,500	2,500	

24 Movements in reserves during year

	PARENT	GROUP
	£'000	£'000
Capital		
Balance at 1st October 1969	2,393	8,338
Retained (part of £1,940,000)	441	550
Premium on issue of shares by a subsidiary company	—	93
Revaluation of assets in overseas subsidiaries	—	1,728
Others	(52)	81
	2,782	10,790
Less goodwill on acquisition of subsidiaries	—	1,438
	2,782	9,352
Revenue		
Balance at 1st October 1969	11,355	21,668
Retained (part of £1,940,000)	(1,079)	1,390
Transfer from minorities	—	174
	10,276	23,232
Total reserves	13,058	32,584

The reserves of overseas subsidiary companies are liable to overseas and United Kingdom taxation if distributed as dividends.

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CX 9-2 25

25 Capital commitments

	PARENT	GROUP
	£'000	£'000
Projects for expenditure on capital account at 30th September 1970:		
Against which orders had been placed	9,211	13,971
Authorised by the directors but not committed	7,974	13,118
	17,185	27,089

26 **Contingent liabilities**

The parent company has contingent liabilities amounting to £4,279,000 in respect of bank and other guarantees, the majority on behalf of subsidiary and associated companies. A subsidiary company has a contingent liability of £28,000 in respect of a guarantee to an associated company.

27 **Pension fund contributions**

The company is under obligation to contribute to the Trustees of The British Oxygen Company's Staff and Works Pension Funds, in respect of improved benefits to employees, £56,550 per annum until 31st March 1972. Two overseas subsidiary companies are under obligation to contribute to the Trustees of their Pension Funds £120,930 per annum over periods varying from five to eighteen years.

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23 COMPARISON OF RESULTS

(21-7-71)

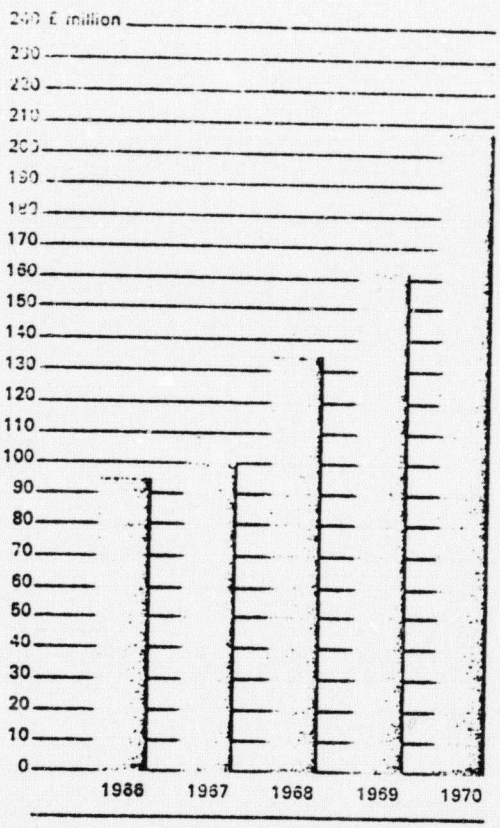
The British Oxygen Company Limited and subsidiary companies

	1966 £'000	1967 £'000	1968 £'000	1969 £'000	1970 £'000
Group sales and profits					
Sales	95,297	99,986	134,363	161,251	207,358
Profit before interest and taxation	12,019	13,036	17,533	19,317	23,946
Less interest	1,969	2,876	3,944	4,236	5,431
Profit before taxation	10,050	10,160	13,589	15,081	18,515
Profit after taxation attributable to ordinary shareholders	4,229	4,349	5,696	5,824	7,582
Exceptional profits less losses after tax	—	1,556	105	815	350
Earnings per ordinary share (excluding exceptional items and adjusted for scrip and rights issues)	2·54p (6·1d)	2·58p (6·2d)	3·25p (7·8d)	3·08p (7·4d)	3·80p (9·1d)
Capital employed					
Ordinary shareholders' capital and reserves	63,227	65,797	78,113	82,531	89,595
Deferred taxation	4,482	6,121	7,157	8,466	8,391
Preference stockholders' capital	2,500	2,500	2,500	2,500	2,500
Interests of minority shareholders	10,239	10,819	13,580	16,503	18,729
Loan capital (incl. bank borrowings)	36,133	53,365	52,749	71,795	80,908
	116,581	138,602	154,099	181,795	200,123
Return on average capital employed (Based on profit before interest and tax)	10·6%	10·6%	12·3%	11·5%	12·5%
	£'000	£'000	£'000	£'000	£'000
Issued ordinary share capital	41,044	41,044	42,771	47,479	49,929
Ordinary dividend rates	10·0%	10·0%	10·4%	11·0%	12·0%
Adjusted for rights issue	9·8%	9·8%	10·1%	11·0%	12·0%
Number of employees					
United Kingdom	15,500	13,200	16,500	18,600	19,400
Overseas	14,500	14,800	15,100	18,500	20,000

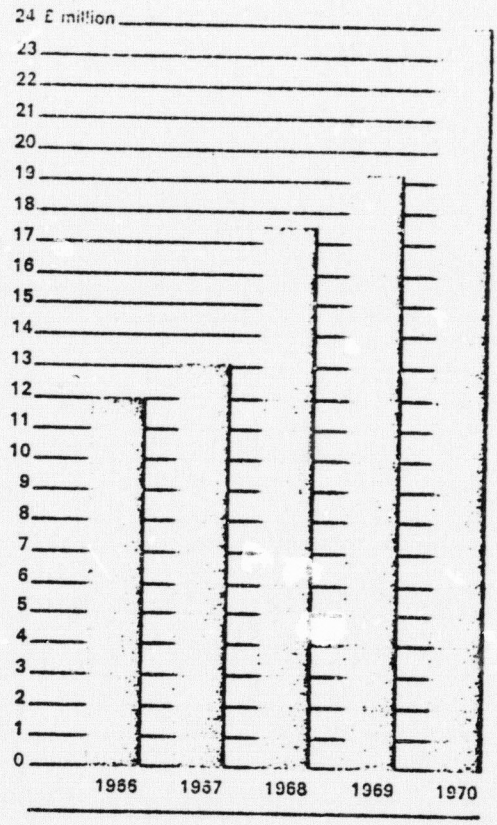
Notes 1. In 1965 £2,500,000 was written off small capacity plants against which a similar amount was released from reserves.
2. From 1967 the number of employees excludes SOC-Airco Cryogenic Plant Ltd.

The British Oxygen Company Limited and subsidiary companies

Group Turnover



Group Profit (before interest and taxation)



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20 MAIN PRODUCTS

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Industrial gases and gas mixtures, liquefied petroleum gases, natural gas, high purity gases, laboratory and rare gases (over 140 gases altogether).

Medical gases.

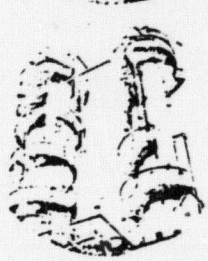
Medical equipment and hospital pipeline systems.

Gas welding and cutting equipment and consumables.

Electric welding equipment and consumables.

Natural gas storage, transport and conversion.

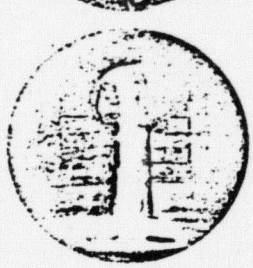
Aircraft breathing equipment.



Carbide and derivatives, petrochemicals, melamine, tall oil products and other chemicals.

Special lubricating and other blended oils for many industries.

Tungsten, molybdenum, tantalum, other metals and alloys and tungsten carbide tools.



High vacuum pumps and components.

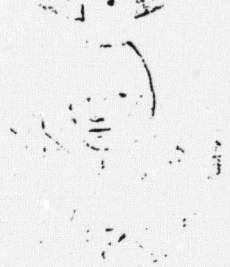
High vacuum processing plant, deposition systems, furnaces, freeze dryers, etc.

Instruments including vacuum gauges and mass spectrometers.

Cryogenic equipment, cryostats, vivostats, helium and hydrogen refrigerators, superconducting magnet systems.

Services to food industry, including freezing, preserving, specialised transportation, refrigerated display cabinets, domestic deep freezers.

Processed and frozen foodstuffs.



Air separation plant and storage vessels.

Mining hardware and earthmoving equipment.

'Sparklets' soda syphons and other consumer products.

Analysis of the holdings of Ordinary shares of 5/- each fully paid as at 30th September 1970

SIZE OF HOLDING 5/- SHARES	NUMBER OF ACCOUNTS	PER CENT OF TOTAL NUMBER OF ACCOUNTS	NUMBER OF 5/- SHARES	PER CENT OF ORDINARY CAPITAL	AVERAGE HOLDING 5/- SHARES
1 - 500	41,440	46	10,116,227	5	244
501 - 1,000	18,838	21	13,958,070	7	741
1,001 - 5,000	25,567	29	52,787,865	26	2,065
5,001 - 50,000	3,166	4	35,189,582	18	11,115
50,001 - 1,000,000	289	—	52,086,009	26	180,228
Over 1,000,000	16	—	35,539,306	18	2,221,207
	89,316	100	199,677,059	100	

The largest holders are mainly insurance companies, pension funds, banks, bank nominee companies and other institutions which, by investing funds belonging to policy holders, pension fund members, depositors, subscribers to unit trusts and others, involve many thousands more people in the fortunes of BOC.

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PRINCIPAL GROUP COMPANIES IN EUROPE

CX 9-2-5

	PERCENTAGE HELD BY: PARENT	SUBSIDIARIES	
UNITED KINGDOM			The British Oxygen Company Ltd
	100		Ace Refrigeration Ltd
	100		Bain and Hodge Ltd
	100		Blackwell's Metallurgical Works Ltd
	100		BOC Holdings Ltd
	100		BOC Transhield Ltd
	100		British Industrial Gases Ltd
	100		British Oxygen Chemicals Ltd
	100		British Oxygen Maydown Ltd
	100		British Solvent Oils Ltd
	100*		Edwards High Vacuum International Ltd
	100		High Speed Steel Alloys Ltd
	100		J. Muirhead Ltd
	100*		Murex Ltd
	100		Murex Welding Processes Ltd
	50		BOC-Airco Cryogenic Plant Ltd
	60		BOC-Linde Refrigeration Ltd
	67		Hirst Welding Rectifiers Ltd
	51		Seaflame Company Ltd
GERMANY	100		BOC Deutschland GmbH
		100	Edwards Hochvakuum GmbH
		100	Heimsyphon GmbH
IRELAND	100		Batchelors Ltd
	75		Irish Industrial Gases Ltd
ITALY		100	Edwards Alto Vuoto SpA
		100	Saccab SpA
NORWAY	100		Odda Smeltevark A/S
SPAIN		85	Murex Hispania SA
SWEDEN	100		Svenska BOC AB

All the above are Ordinary shareholdings except those marked with an asterisk which indicates Preference shares.

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	PERCENTAGE HELD BY PARENT	PERCENTAGE HELD BY SUBSIDIARIES	
AUSTRALIA	59		The Commonwealth Industrial Gases Ltd
CANADA	100		Canadian Oxygen Ltd
	33		Canadian Helium Ltd
		100	Edwards High Vacuum (Canada) Ltd
CEYLON	100		Ceylon Oxygen Ltd
HONG KONG	100		British Oxygen (Hong Kong) Ltd
		50	Hong Kong Oxygen & Acetylene Co Ltd
INDIA	66		Indian Oxygen Ltd
KENYA		89	East African Oxygen Ltd
MALAYSIA	100		Malayan Oxygen Sdn Berhad
NEW ZEALAND	63		New Zealand Industrial Gases Ltd
NIGERIA	50		Industrial Gases Ltd
PAKISTAN	59		Pakistan Oxygen Ltd
RHODESIA		100	Rhodesia Oxygen (Pvt) Ltd
SINGAPORE	100		Singapore Oxygen Pte Ltd
SOUTH AFRICA		65	African Oxygen Ltd
TANZANIA		100	Tanzania Oxygen Ltd
UGANDA		40	Uganda Oxygen Ltd
USA	50		Airco-BOC Cryogenic Plants Corporation
		100	Edwards High Vacuum Inc
	100		Leland Industries Inc
ZAMBIA	100		Zambia Oxygen Ltd

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32 SHAREHOLDERS' CALENDAR

Shareholders' and Stockholders' Calendar: Dividend and Interest Payments

Ordinary shares	Interim announced June paid September
	Final proposed December paid March
Preference stocks	Paid half yearly, 30 June, 31 December
5¾% and 6¾% Debenture stocks	Paid half yearly, 15 May, 15 November
8½% and 11% Tonnage Debenture stocks	Paid half yearly, 15 June, 15 December
7½% Convertible Unsecured Loan stock	Paid half yearly, 15 July, 15 January

Conversion dates	*Number of Ordinary shares of 5/- for each £100 stock converted*
31 March 1971	200
31 March 1972	185

Announcement of Group Results

Three months' results	March
Half year's results	June
Nine months' results	September
Year's results	December
Report and Accounts	February

Capital Gains tax

For capital gains tax purposes the market values of BOC Ordinary shares, Preference stocks and Loan stocks at 6 April 1965 were:

Ordinary shares of 5/-	9/0¾d
6½% Cum pref stock £1 units	19/9d
5% Cum 2nd pref stock £1 units	14/6d
4% Cum 2nd pref stock £1 units	11/3d
5¾% Debenture stock 1981/86	£87
6¾% Debenture stock 1985/90:	
fully paid	£99½
£50 paid	£51½

The Company is not a close company within the meaning of the Finance Act 1965

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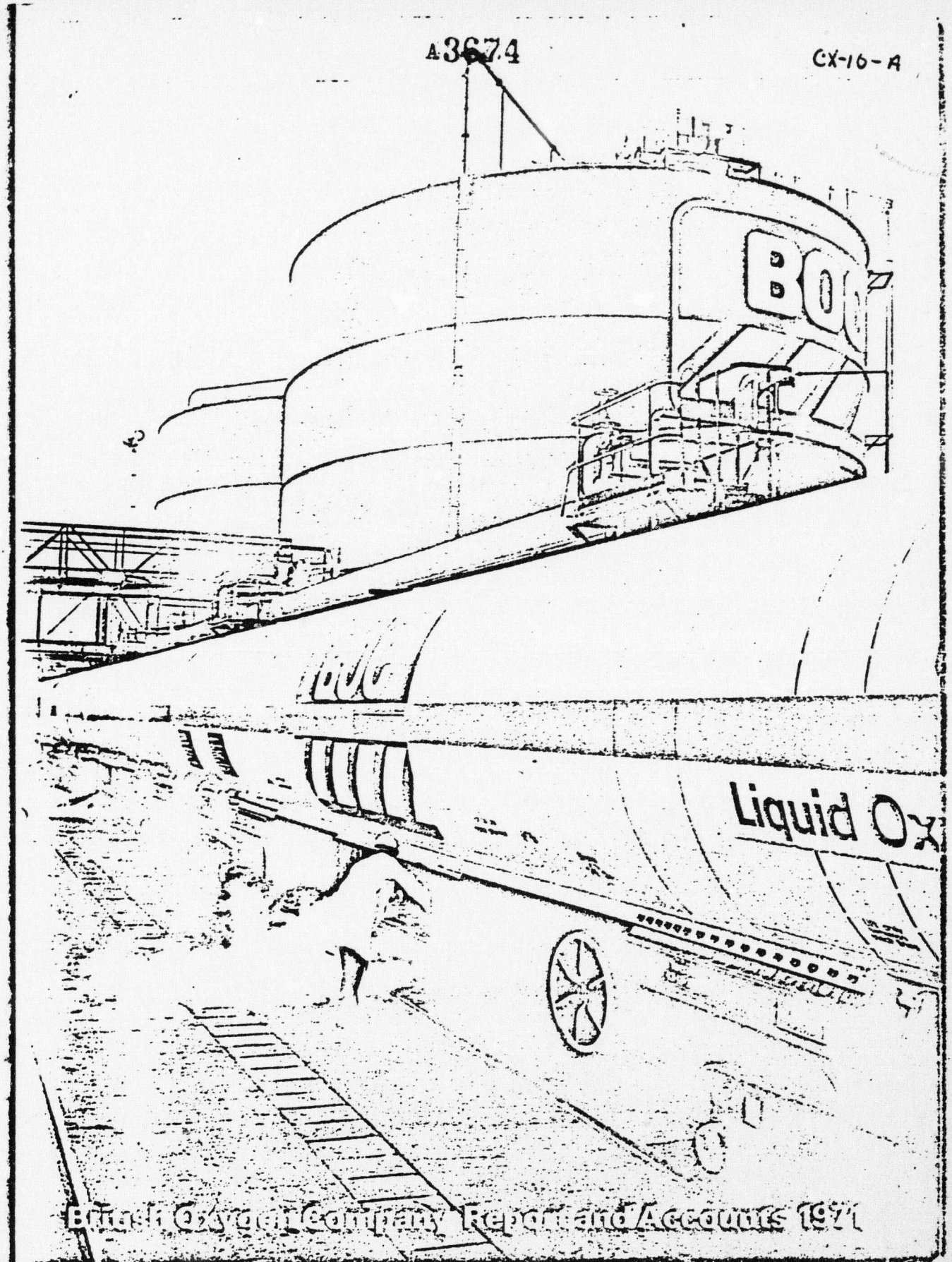

British Oxygen Company Report and Accounts 1971

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Group results at a glance

	1971 £'000	1970 £'000
Sales	234,582	207,858
Trading profit		
UK and Europe	14,933	12,420
Overseas	15,110	14,115
	30,043	26,535
Disposable profit		
Dividends and shareholders' income tax	6,155	6,114
Retained profit	2,407	1,940
	8,562	8,054
Average capital employed	211,138	191,459
Return on capital	13.1%	12.5%
Earnings per share	4.16p	3.80p
Ordinary dividend	12%	12%

Front cover
The new 1,400-ton per day plant at Widnes with one of its cryogenic tanker trains. They can each carry 550 tons of liquid gas at minus 196°C, a load which would otherwise call for 30 of BOC's largest road tankers.

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The British Oxygen Company Limited

Directors' Report and Accounts 1971

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Notice of Meeting

NOTICE IS HEREBY GIVEN that the eighty-sixth Annual General Meeting of The British Oxygen Company Limited will be held at the Confederation of British Industry, Council Chamber, 21 Tothill Street, London SW1, on Tuesday 29th February 1972 at 12 noon.

1 To receive and consider the statement of accounts and the reports of the Directors and Auditors thereon and to declare a dividend.

2 To elect Directors.

3 To authorise the Directors to fix the remuneration of the Auditors.

4 To transact any other business that may be transacted at an Annual General Meeting.

By order of the Board
C A B Leslie
Secretary

NOTES

1 Only holders of Ordinary shares are entitled to attend or be represented at the meeting. A member entitled to attend and vote may appoint one or more proxies to attend and vote instead of him. A proxy need not be a member.

2 A statement has been drawn up for the period to 7th January 1972 of all transactions of each Director, and so far as he can reasonably ascertain of his family interests, in the equity share capital of the Company and any of its subsidiaries. It will be available for inspection at the Registered Office of the Company, Hammersmith House, London W6, during usual business hours (Saturdays and public holidays excluded) from the date of this Notice until 29th February 1972 and at the Confederation of British Industry, Council Chamber, for a period of 15 minutes prior to and during the Annual General Meeting.

3 Warrants will be posted on 10th March if the proposed dividend is approved.

Registered Office:
Hammersmith House
London W6
4th February 1972

A Proxy Card is enclosed for holders of Ordinary shares

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The British Oxygen Company Limited

Board of Directors

Chairman	J S Hutchison
Vice Chairman	Sir Geoffrey Eley, CBE
	Sir Duncan Anderson, KBE, TD
	Sir John Cowley, GC, KBE, CB
	Sir Charles Elworthy, GCB, CBE, DSO, MVO, DFC, AFC
	Sir Owen Wansbrough-Jones, KBE, CB
Group Managing Director	L E Smith
Managing Directors	R C Hesketh-Jones
	P Laister
	J M Williams

Chief Executives

Trading Divisions	
Advanced Engineering	A I A Ray
Chemicals	D R Scarffe
Cryoplants	A F Kaulakis
Food Services	D W E Stafferton
Gases	D W N Pitts
Metals	G Winfield
Welding Products	N F J Reckitt
Corporate Divisions	
Company Secretary	C A B Leslie
Corporate Marketing Adviser	D Melvin
Finance & Planning	M J Shanks
Management Services	B W Mills
Personnel	J H Walwyn, CB, OBE
Public Relations & Marketing Services	A Eden-Green

Auditors

Cooper Brothers & Co

Chairman's statement

Profits

Profits increased steadily throughout last year though at a slower pace than we had expected. The trading recession in the UK and economic restriction in other countries in which we operate had a retarding effect: in addition, the year included several unusual and non-recurring features which added to its difficulties.

The prolonged postal strike early in the year hit with particular severity those Divisions which depend heavily on the mail for despatch of their products. More widely the strike also gave rise to a substantial slowing down in debt collection with a consequent large increase in bank borrowings and interest costs.

Later in the year there developed a worldwide cyclical recession in refractory metals and alloys. This, and the accompanying severe drop in raw material prices, made it necessary to write down stocks by some £430,000 and eliminated earlier profits of Metals Division.

Overseas, trading in East and West Bengal was badly upset by the very disturbed conditions in those areas, and changes in special markets in Singapore and Hong Kong reduced earnings there. Furthermore, the sterling value of our overseas earnings for 1970/71 was reduced by over £200,000 by application of the floating exchange rates at the year-end.

Dividend

The Directors recommend the same total rate of Ordinary dividend as in the previous year, leaving an increased balance of profit to carry forward. As described, the past year had many difficulties and although the outlook is now improving somewhat, there has been little practical advance so far. In these circumstances the Directors consider it prudent to recommend that we should rest at the present rate of dividend for this year and increase the profit balance carried forward.

Finance

My forecast a year ago that the pace of our investment in new capital assets might be modified in the present period and for some time ahead, is proving correct. This trend of lessened capital expenditure seems likely to continue and with our cash flow increased to about £20 million per annum, and with greater freedom and variety now in bank borrowings and other short-term loan accommodation, we are happily placed at this stage in arranging our finances to best advantage. The recent revision and modernisation of our Debenture Trust Deeds, too, has given us improved freedom to fund a proportion of our bank indebtedness or short-term borrowings if this should seem to us to offer advantage. We have no present plans, however, to make any important changes in our financial arrangements and we see no need for additional equity capital.

Common Market

British membership of the EEC is unlikely to have any immediate effect on our trading. In the medium or longer term we should be able to extend our influence throughout the community in products such as welding and cutting equipment, medical appliances and consumables for electric welding. Our existing investments in Continental companies operating in these fields give us a basic operational position from which to develop and ensure that we could move promptly to take advantage of any new opportunities that might occur.

Industrial gases remain our predominant interest. Benefit from EEC membership in this important area of our trading is likely to be indirect and to arise, probably after some interval, from the improvement in British industry generally. It is my belief that there will be a considerable upsurge at home in due course but time is certainly required before the new conditions arising from Common Market membership can be fully understood and accommodated. Gains for us from Common Market membership therefore, substantial though they may become in time, must lie some distance ahead and are unlikely to have any effect on our trading in the current year.

Exchange Rates

A more immediate influence, and one with which we shall all certainly have to reckon, is the realignment of international exchange parities. This must affect the economies of the countries in which we operate and it will not be apparent for some time whether any resultant improvement in their trading will be of sufficient strength to offset the lessened sterling value to us of their profits under the new exchange rates.

Management

The leadership and foresight again evinced by our Managing Directors at home and overseas have set

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Chairman's Statement *(continued)*

an example which chief executives and managers everywhere have been quick to follow when dealing with the many unexpected features of the past year. One of the most important aims in our organisation is to generate broadened work participation and interest, as well as to expand opportunity for our employees in every way possible. All concerned must share the benefits of putting their best into their job. We are having considerable success in this, I am glad to say, encouraging us to devolve responsibility and enlarge work scope whenever and wherever there is opportunity.

Many of our people in India, Pakistan, Ceylon and Northern Ireland have had to face quite abnormal situations of difficulty and I very much appreciate their loyalty and devotion to duty in these circumstances. I thank them all, as I also thank the many in the organisation at all levels who made last year's advance possible.

Board

We suffered an unexpected loss during last year through the untimely death of Mr John L Hardie. Mr Hardie was a member of the Board for twenty years and at all times played a constructive and interested part in our affairs: we much regret his passing.

We have been fortunate to appoint to the Board Sir Charles Elworthy GCB CBE DSO MVO DFC AFC in May last, on the conclusion of his appointment as Chief of the Defence Staff. His appointment to the Board comes before you for confirmation.

Sir Duncan Anderson KBE TD has attained the age of 70 and will retire from the Board at the annual meeting. Sir Duncan joined the Board in 1962 and brought a worldwide experience and knowledge to our councils: we shall greatly miss his wise and kindly presence.

Mr Ian James Fraser, will join the Board in April next after his current position as Director-General of the Panel on Take-overs and Mergers terminates. I am delighted to be able to announce this and to look forward to the strength and experience he will bring to us.

I will retire as Chairman and from the Board on 29 February 1972. The Directors have appointed Mr Leslie E Smith, presently Group Managing Director, to succeed me as Chairman. I am sure there could be no better choice and I am happy to extend every good wish to Mr Smith on his appointment.

Prospects

Changes made, or proposed, by the present government are greatly improving the economic climate in which UK industry operates. Particularly welcome are the changes in taxation, better incentives for individuals, the general liberation of bank finance, and last but in my view by no means least, the reduction of interest rates which has given direct help to the increased capital investment our country so badly needs and is of wide-ranging benefit throughout the national price structure. These are early days, but the cumulative effect of these measures will be far-reaching and, I am sure, of major importance to all of us.

Our own immediate plans project further advance in the current year in all sections of our business at home and overseas. Such advance can only be realised, however, if the environments in which we trade respond to the current political and economic promptings. So far we see no more than slight signs of improvement, and real benefit is unlikely now to emerge before the second half of our financial year; but I hope it will be in time to give us a further improvement in our profits.

J S Hutchison

London
4th February 1972

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Report of the Directors

The Directors submit their report and statement of accounts for the year ended 30th September 1971.

The Group profit and loss account is summarised thus:

		£'000
Trading profits after tax attributable to parent Company		8,492
Exceptional profits, less losses, after tax		70
Profit available for distribution		8,562
Dividends already paid:		
Preference	122	
Ordinary interim of 4%	2,011	
		2,133
Directors recommend:		
Final ordinary dividend of 8%	4,022	
Profit retained	2,407	
		6,429
		8,562

At home the major contribution was again made by Gases Division, where sustained effort to revise and improve management methods, particularly in marketing, has produced substantial benefits. A valuable contribution was made also by Advanced Engineering Division, where both medical equipment and Edwards High Vacuum showed greatly improved results.

In Food Services and Chemicals Divisions, 1970/71 was a year of development and consolidation, with management effort concentrated on promoting those activities having best profit growth potential and eliminating some showing less promise.

Welding Products Division had a difficult year against a background of reduced UK demand, but made substantial strides in improving the organisation of various phases of activity. Hardest hit of all, Metals Division operated for most of the year in a situation of low demand and depressed prices. Overseas, amongst the larger companies both CIG (Australia) and Indian Oxygen produced higher profits. African Oxygen and Canadian Oxygen were held back by the condition of their national economies.

Detailed comments on the main activities of the major trading units follow below:

Gases Division

Trading conditions remained highly competitive throughout the year with constant pressure on margins. A significant drop in demand from manufacturing industry was experienced in the second half-year when rising costs became a particularly serious problem demanding constant management attention.

Two major tonnage plants were opened during the year. A 720-ton per day oxygen plant was commissioned at Middlesbrough in record time, and the 1,400-ton per day liquid oxygen/nitrogen plant at Widnes, the kernel of the 'Plan 70' centralised production and rail distribution facility. This plant was inaugurated by Mr Richard Marsh, Chairman of British Rail.

The Widnes plant and its associated cryogenic tanker trains and terminal points at Wembley, Wolverhampton and Sheffield, were designed by BOC-Airco (now Cryoplants Ltd) and installed and completed on schedule. They fulfil the 'Plan 70' concept which not only gives BOC unrivalled

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ability to serve the steadily growing market for industrial gases throughout the UK, but also has made it possible to close down 21 of our older, smaller plants, which are no longer economic with today's greatly increased requirements. Gases Division now has 39 tonnage plants at 18 different sites with daily capacity of up to 9,500 tons of oxygen together with a very large nitrogen capacity.

In natural gas conversion work the joint company 'Seaflame' operated successfully, particularly in the London area. A Fuel Gas Services Department recently established has dealt with the transport of liquid petroleum gas for a number of Gas Boards and has completed arrangements with a major petroleum company for the movement of ethylene in BOC liquefied natural gas tankers. An exclusive licensing arrangement has been completed, too, with NV Petrogas for the supply of pressure reducing stations for the gas industry.

The Division recently became exclusive distributors of Du Pont Freon fluorinated hydrocarbons for the UK refrigeration market.

Advanced Engineering Division

The main activities of Advanced Engineering Division are medical and aviation equipment and Edwards High Vacuum. The progress reported last year has continued and greatly improved profits have been generated in spite of the general downturn of engineering orders in the UK.

Edwards High Vacuum had a successful year although orders for industrial vacuum equipment both in the UK and the USA have been at a lower level. This has been offset by expansion in several overseas markets, especially Japan where a joint company has been formed with Nippon Sanso. Sales of EHV products go well in Japan and local manufacture should start there next year.

Our medical equipment business has grown both in home and export markets. The new factory at Harlow reached capacity earlier than expected and has required extension to support our widening product range.

A new factory to house the Edwards High Vacuum operation in Italy was completed and rapidly brought into full operation alongside our medical equipment factory in Milan.

Chemicals Division

This Division operates in England at Chester-le-Street, in Northern Ireland at Maydown and in Norway at Odda. Progress has been made in each area.

At Chester-le-Street part of the polyvinyl acetate emulsion business was sold, the part retained being for adhesives which, though smaller, offers better prospects of profitable expansion. In melamine we have used the facilities of Cyanamid of Great Britain Ltd. to [illegible] position. In preparation for UK entry into the European Economic Community. Another development at Chester-le-Street was the construction of a £1¼ million tall oil refining facility to double existing capacity to nearly 50,000 tons per annum. It is due on stream early in 1972.

At Maydown, there was a marked improvement in the performance of the Wulff acetylene plant, fully justifying the expenditure and the managerial time and effort of the past few years. This success enabled us to negotiate a new and more acceptable agreement for the bulk acetylene supply from this plant. The ethylene dichloride plant at Maydown was shut down in October in agreement with our customer Norsk Hydro; neither company could afford to comply with rigorous new Norwegian shipping regulations for chlorine which would have required substantial investment and consequent losses in operation.

At the third major site, Odda in Norway, the year was marked by the solution of the production problems arising from the greatly increased plant capacity installed over the past two years. Record operating levels have recently been achieved, but continuing increases in raw material and labour costs and in taxation overshadow the outlook in [illegible] petitive world market.

BOC-Airco Cryogenic Plant Limited (now Cryoplants Limited)

Major plants designed and built by BOC-Airco were completed last year at Widnes and Middlesbrough for Gases Division. There is in hand a Gas Council contract for a liquid natural gas peak shaving plant at Partington and field work continues for other plants for Gases Division, principally at Middlesbrough and Scunthorpe.

Whilst a number of 'third party' orders have been obtained, profitable business has been difficult to find in the circumstances of the past year. In particular, the USA market failed to provide the expected number of plants to be built in the UK for sale in the American market. It was therefore mutually agreed with Air Reduction Inc that the joint venture set up in 1967 should be brought to an end. BOC sold its 50% share in Airco-BOC Cryogenic Plants Corporation of New Jersey and purchased 50% of BOC-Airco Cryogenic Plant Limited. Thus the UK plant building facility based at Edmonton has reverted to BOC and now operates as a BOC trading division under the name Cryoplants Limited.

Food Services Division

The second full year of operation for Food Services Division brought further progress and increased profits.

In the distribution field, BOC Transfield set up only last year, has built and commissioned [illegible] important distribution centres at Barnsley, Bristol

Continued on page 11

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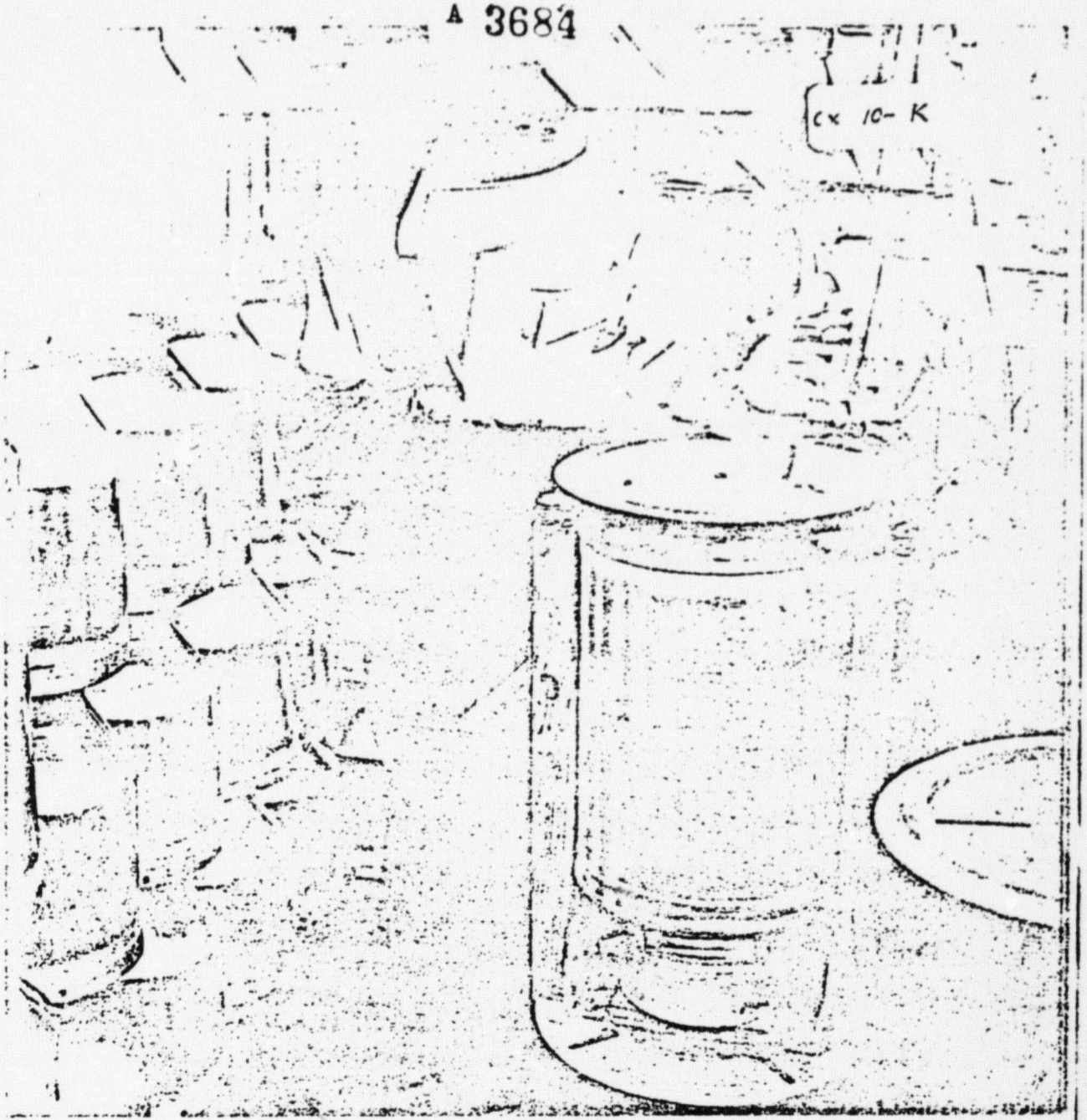

Swifts of Scarborough have installed BOC LMG automatic welding equipment and increased their production of aluminium mill chassis by 50%. Over 2,000 chassis are being made for shipment to Venezuela.

and Camberwold to extend and strengthen our service to Marks & Spencer's expanding food business. These, coupled with existing depots and the Transhield fleet of modern Polarstream refrigerated vehicles, provide a nation-wide distribution network. We are now disposing of the balance of the original Bain & Hodge general haulage companies not required since completion of the Transhield organisation.

In food processing, progressive improvements in productivity at Batchelors and more effective marketing held the profit position during a year when an early glut of fresh vegetables caused problems throughout the processing and frozen foods industries. Our interests in this area have recently been extended by participation in a Spanish company operating a new food freezing venture at Badajoz, Spain. Ace Refrigeration, distributors of frozen food cabinets, and J Muirhead, distributors of frozen foods in the UK, have continued to expand and to improve profits.

Small ventures which are at an early stage have been set up in the UK and USA to market a new oven combining the unique advantages of cooking by air convection and micro-wave. This operation and our Sparklets consumer products range have, at the end of the year, been placed in a new Consumer Products Division. For its part, Sparklets has extended its range and its sales with a new larger syphon designed for family use, and had an improved year as had the associated business Heimsyphon GmbH in Germany.

Metals Division

The second half of the year brought very difficult trading conditions for the Metals business. Demand from the steel industry for alloy materials declined to an acutely low level and such trade as was possible could only be transacted at very depressed prices. The Division incurred a loss for the year.

In December 1970 we acquired for $Can.14 million, the issued share capital of the Canadian corporation Deloro Stellite, which has as its most important subsidiary Deloro Stellite (UK) Ltd of Swindon, and small associated operations in Western Germany and Sweden. Deloro Stellite produces and applies to a wide range of engineering products a family of cobalt chrome alloys of particular use in producing hard and corrosion resistant surfaces. This new acquisition, whilst not having an easy time because of the generally adverse trading conditions, has maintained its profitability.

Another development was the formation of BOC Minerals as a separate trading entity designed to [illegible] management expertise on the procurement, [illegible] and minerals so as to maximise both [illegible] and longer term profitability of [illegible]

Welding Products Division

Despite the drop in home demand because of recession in the engineering industries in the UK, this Division was again able to increase turnover. The general inflationary situation however led to rapidly rising costs and, in consequence, some decline in margins. The year was accordingly an opportunity for consolidation in organisation and in realignment of production, and of strengthening our position in the markets in which we operate.

At home, the increase in market share of most products was achieved by continuing the policy of presenting the customer with a complete range in arc and gas welding and gas cutting, and decentralising distribution to ensure that products were available close to the point of sale. Many new divisional sales centres were opened in support and a much closer association developed with our distributors.

The Olympia Exhibition in April provided an opportunity for a practical demonstration of our total resource from welders' accessories to large cutting machines, with many new products available in all sectors. Particular interest was shown in the new Lynx Ranger which gives the operator the ability to weld semi-automatically up to 100ft away from the basic equipment—a world first. Also featured was the new Kestrel cutting machine which gives co-ordinate drive at a new low price level.

In accordance with the policy of establishing logical product profit centres within Divisions, a new factory for automatic welding equipment was opened in the middle of the year at Knowsley, Lancashire. At the end of the year a second factory was opened at Bletchley to concentrate on the manufacture of gas welding and cutting nozzles.

The new European joint venture announced during the year now operates under the name of Smit Weld in Holland, Belgium and Germany, so that we now have an established manufacturing position on the continental mainland.

Overseas

In the overseas operations outside Europe, profits increased by 7% to £15,110,000 despite more difficult trading conditions. Most companies experienced substantial cost inflation.

In Australia, Commonwealth Industrial Gases Ltd had another good year. Developments included a 100-ton per day plant to supply oxygen and nitrogen to two chemical companies in Sydney, the completion of a first carbon dioxide producing plant and the formation of a joint venture in Indonesia with two Government-controlled companies to enter the industrial gas business in Java. New Zealand Industrial Gases Ltd did well to maintain its profits in difficult trading conditions. In South Africa, further progress was made in the improvement of profitability of the companies

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acquired in 1969 and, despite increased competition in industrial gases and continued restraint of business activity, earnings were maintained. A new electrode factory at Brits was completed and partially occupied and plans have been completed for a 100-ton per day liquid oxygen/nitrogen plant on the Reef in 1972. The 184-ton per day plant installed for Highveld Steel was commissioned during the year.

Indian Oxygen had a good year and appreciably improved results despite chronic labour difficulties in West Bengal and raw material shortages. Comprehensive development plans have had to be deferred because of Government policy directed against further development of large companies or those having substantial foreign ownership. The situation remains under close examination.

In Pakistan trading was interrupted by the military operations in East Pakistan and by the efflux of refugees. Increased taxation and raw material shortages also cut down earnings. The vigorous growth noted last year in Singapore received a setback, principally due to a recession in the semiconductor industry, and similar conditions applied in Hong Kong.

The Canadian economy was depressed throughout the year and Canox results were rather lower than expected. Progress was made in integrating the welding and gas business acquired from Air Reduction Inc in 1970. One important aspect of this acquisition was to establish Canox in the Canadian carbon dioxide market.

Research and Development

Trading divisions in the UK and the larger Overseas companies are responsible for their own product and process development. Additionally, there is a central Research and Development activity whose objective has been re-directed to developing not new products but new business ventures. The effect is to place greater emphasis on the profit orientation of research work and the promotion of viable pilot ventures for eventual incorporation in our trading operations. Accordingly, this central activity has been named New Venture Secretariat.

One pilot venture—Cryogenic Refrigeration Systems—had its first successful year, among its achievements being a contract to supply a helium refrigerator using the unique BOC gas bearing expansion turbine for the next superconducting motor/generator system to be built by International Research and Development Company Limited for the Ministry of Defence.

CRS has also delivered two large systems during the year—a helium purification unit to the Nuclear Power Group, and a complex helium refrigerator to the Culham Laboratories of the Department of Trade and Industry.

Elsewhere in New Venture Secretariat, the Department of Trade and Industry is assisting a project aimed at improving the quality and application of underwater welding.

Other Corporate Activities

The primary roles of the Corporate Divisions are to advise and service line management and to provide certain specialist services for the Group as a whole. In a decentralised trading organisation, these support services must be strong and of high quality, but for the most part they do not call for special mention in the context of the Annual Report. The following features are however worthy of note.

Finance and Planning

Finance Division has been widened to include Group planning and the co-ordination of activities on the continent of Europe as it is no longer realistic to separate the management of the Company's broad finance and investment activities from that of total marketing strategy. Responsibility therefore for the Planning Secretariat and Commercial Intelligence Units as well as those of European Co-ordination, has now been grouped with the finance function.

Manpower Development Unit

BOC is expanding rapidly, and its markets and technologies are subject to continuous change. In these circumstances it is essential that the personnel needed for the future should be identified and developed. A Manpower Development Unit has been set up therefore to focus attention on the range of skills and techniques needed to ensure best utilisation of manpower resources in future years.

Debenture Trust Deeds

Debenture stockholders have approved proposals, which are now effective, for modernisation of the Trust Deeds originating in 1957, securing the Company's 5¾% and 6¾% Debenture Stocks. The old Deeds had become inappropriate and no longer formed a satisfactory basis for further issues of Debenture Stock. Under the new arrangements designated subsidiaries, mostly overseas, have freedom to finance their growth and development by secured or unsecured borrowings without affecting BOC's own borrowing powers.

These arrangements are quite apart from Tonnage Debentures which are issued on the security of plants installed under firm contracts for the supply of industrial gases for fixed periods of years to customers of prime standing. These plants, and the contracted income from them, offer lenders a particular and readily acceptable quality of security.

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Directors and Auditors

The Directors are named on page 4. Mr J L Hardie retired on 17th May 1971 (see Chairman's Statement, page 6). The Director retiring by rotation is Sir Owen Wansbrough-Jones KBE CB who is willing to be reappointed.

Sir Charles Elworthy GBE KBE DSO MVO DFC AFC was appointed to the Board on 18th May 1971. He retires at the Annual General Meeting in accordance with Article 95 and, being eligible, offers himself for re-election.

Sir Duncan Anderson retires having attained the age of 70 on 10th June 1971.

As mentioned in the Chairman's Statement (see page 6) Mr J S Hutchison will retire from the Chairmanship and from the Board at the conclusion of the Annual General Meeting.

The Auditors, Cooper Brothers & Co. continue in office in accordance with Section 159(2) of the Companies Act 1948.

Directors' Interests

The Register kept by the Company for the purpose of Section 27 of the Companies Act 1967 shows that the number of Ordinary shares and amounts of Stock of the Company in which the Directors of the Company and their families had an interest as at 1st October 1970 and 30th September 1971 were as follows:

		BENEFICIAL HOLDINGS		OTHER HOLDINGS	
		30/9/71	1/10/70 or at date of appointment	30/9/71	1/10/70
Mr J S Hutchison	Ordinary	55,000	55,000	—	—
As Trustee	Ordinary	—	—	25,000	25,000
As Trustee	5¾% Debenture Stock 1981/86	—	—	£5,275	£5,275
As Trustee	6¾% Debenture Stock 1985/90	—	—	£13,950	£13,950
Sir Geoffrey Eley	Ordinary	15,595	15,595	—	—
As Trustee	Ordinary	—	—	24,464	20,784
Sir Duncan Anderson	Ordinary	10,000	10,000	—	—
Sir John Cowley	Ordinary	3,200	4,475	—	—
Sir Charles Elworthy	Ordinary	2,000	2,000	—	—
Sir Owen Wansbrough-Jones	Ordinary	5,280	5,280	—	—
Mr L E Smith	Ordinary	1,000	1,000	—	—
	Ordinary (5% paid)	55,000	55,000	—	—
Mr P Laister	Ordinary	1,000	1,000	—	—
	Ordinary (5% paid)	45,000	45,000	—	—
Mr J M Williams	Ordinary	2,000	2,000	—	—
	Ordinary (5% paid)	45,000	45,000	—	—
Mr R C Hesketh-Jones	Ordinary	4,042	4,042	—	—
As Trustee	Ordinary	—	—	2,009	2,009
	Ordinary (5% paid)	45,000	45,000	—	—

No Director has a beneficial interest in any shares or debentures of any subsidiary company.

The interests of the Directors and their families, in each case, do not exceed 5% of the issued capital or debentures of the Company or of any subsidiary.

No Director has a service contract which does not expire, or which is not determinable by the Company without payment of compensation, within one year.

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Interests in Company's share capital

So far as can be ascertained no one person or corporation holds or is beneficially interested in any substantial part of the share capital of the Company.

Share and Loan Capital

During the year the following new issues were made:

£10,000,000	11% Tonnage Debenture Stock 1992 for cash at par.
75,000	Ordinary shares of 25p each as part consideration for the acquisition of Ace Refrigeration Ltd.
1,330,320	Ordinary shares of 25p each as a result of conversion of £665,160 7½% Convertible Unsecured Loan Stock 1987/92 by stockholders in accordance with the terms and conditions of the Trust Deed constituting the stock.
3,178	Ordinary shares of 25p each as part consideration for the acquisition of Prochem Ltd.
107,500	Ordinary shares of 25p each 5% paid under the terms of the Share Incentive Scheme.

Charitable and political contributions

During the year ended 30th September 1971 Group companies in the United Kingdom made charitable and educational payments totalling £40,000.

In accordance with long established practice no political contributions were made by the group in the UK.

Exports

The value of goods exported by the group from the United Kingdom was as follows:

	£'000
to BOC companies	3,924
to others	11,612
	15,536

Profits earned from overseas investment, after allowing for local taxation and the interests of minority shareholders, totalled £4,872,000 for the year.

Employees in the UK

Average number employed	19,640
Aggregate remuneration	£34,104,000

By order of the Board
C A B Leslie
Secretary

London
4th February 1972

Shareholders

Analysis of the holdings of Ordinary shares of 25p each fully paid as at 30th September 1971

SIZE OF HOLDING 25p SHARES	NUMBER OF ACCOUNTS	PER CENT OF TOTAL NUMBER OF ACCOUNTS	NUMBER OF 25p SHARES	PER CENT OF ORDINARY CAPITAL	AVERAGE HOLDING 25p SHARES
1 - 500	38,219	45	9,498,392	5	249
501 - 1,000	18,022	21	13,438,513	7	746
1,001 - 5,000	24,900	30	51,546,119	25	2,070
5,001 - 50,000	2,907	4	31,569,472	16	10,860
50,001 - 1,000,000	287	—	56,609,605	28	197,245
Over 1,000,000	17	—	38,423,456	19	2,260,203
	84,352	100	201,085,557	100	

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To the Members of The British Oxygen Company Limited

In our opinion, based on our examination and the reports of the auditors of certain subsidiaries not audited by us, the accounts set out on pages 16 to 29 together give a true and fair view of the state of affairs at 30th September 1971 and of the profit for the year ended on that date and comply with the Companies Acts 1948 and 1967.

Cooper Brothers & Co.
Chartered Accountants

London
4th February 1972

Consolidated Profit and Loss Account

	1971	[illegible]
	£'000	[illegible]
Sales *note 9, page 18*	234,582	[illegible]
Trading profit *note 10, page 19*		
United Kingdom and Europe	14,933	12,420
Overseas	15,110	14,115
	30,043	26,535
Less **development and research** *note 5, page 18*	2,424	2,589
	27,619	23,946
Less **interest paid** *note 11, page 19*	7,894	5,431
	19,725	18,515
Less **taxation** *note 12, page 19*	8,883	8,548
	10,842	9,967
Less **attributable to minority shareholders**	2,350	2,263
Trading profit after tax attributable to parent company *note 6, page 18*	8,492	7,704
Exceptional profits less losses after tax adjustments *note 15, page 20*	70	350
Available for disposal *note 16, page 20*	8,562	8,054
Dividends:		
Preference	122	122
Ordinary: interim 4% (1970 3%)	2,011	1,498
proposed final 8% (1970 9%)	4,022	4,494
	6,155	6,114
Retained profit	2,407	[illegible]
	8,562	[illegible]

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EX 10-R

[illegible]			[illegible]	
1971			1971	
£'000			£'000	
64,922		Fixed assets *note 1, page 18 and note 17, page 21*	142,292	
70,389		Subsidiary companies *note 18, page 22*	—	
1,214		Investments *note 19, page 22*	2,964	
41,086		Current assets *note 20, page 23*	133,866	
177,611			279,122	
33,248		*Less* current liabilities and provisions (including bank overdrafts) *note 21, page 23*	75,802	
144,363			203,320	
		Financed by:		
50,282	49,929	Issued ordinary shares of BOC *note 25, page 24*	50,282	49,929
7,270	7,082	Share premium	7,270	7,082
12,317	13,058	Reserves *note 26, page 27*	31,560	32,584
69,869	70,069	Ordinary shareholders' interests	89,112	89,595
2,500	2,500	Issued preference stock of BOC *note 25, page 24*	2,500	2,500
—	—	Minority shareholders' interests	20,083	18,729
72,369			111,695	
38,977		Long term loans *note 22, page 23*	51,676	
26,171		Short term loans *note 23, page 24*	29,513	
6,846		Deferred taxation *note 4, page 18*	10,436	
144,363			203,320	

Signed on behalf of the Board:
J S Hutchison *Director*
L E Smith *Director*

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ACCOUNTING PRINCIPLES

1 Fixed assets

(a) United Kingdom investment grants are deducted from the cost of the asset.

(b) Depreciation is calculated to write off the assets (other than certain tonnage plants) during their expected normal lives by equal annual instalments (the straight line method) at rates ranging from 2½% to 25% per annum depending upon the type of asset. Depreciation on tonnage plants commissioned since 1st October 1969 is calculated on an annuity basis.

(c) Specific provision is not made for the replacement of fixed assets but, in the opinion of the directors, profits retained and borrowing facilities available are adequate for this purpose.

2 Stock and work-in-progress

Stock and work-in-progress is valued at cost or net realisable value whichever is lower, and cost where appropriate includes a proportion of overhead expenses. Profits are not taken on construction contracts until completion but provisions are made for all known or anticipated losses.

3 Debtors

Known bad debts are written off and specific provision is made for any considered to be doubtful of collection. In addition, general provisions of 1% to 2½% are made on the balance of sales ledger debts.

4 Deferred taxation

This represents taxation at current rates on the amount by which accumulated taxation capital allowances on plant and equipment exceeds provisions made in the accounts of the Group for depreciation and is reduced by expenditure not deductible for tax purposes until later years.

5 Development and research expenditure

Group expenditure (which comprises the costs of operating the development and research centres, United Kingdom and Overseas, inclusive of appropriate overheads) is written off when incurred.

6 Trading profit

It is policy to arrive at trading profit reflecting normal trading conditions and to show separately:

(a) exceptional profits and losses arising during the year,

(b) tax provisions and other items not relating to the current year and

(c) capital profits and losses.

7 Investment income

Only dividends received, or declared and receivable, are included in trading profit.

8 Exchange rates

All currency figures are converted at the rates of exchange ruling at the financial year end.

9 Sales

Sales are based on invoiced value excluding inter-company sales.

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CONSOLIDATED PROFIT AND LOSS ACCOUNT DETAILS

	1971 £'000	
10 Trading profit shown is after charging:		
Depreciation—United Kingdom and Europe	9,211	
Overseas	5,425	
	14,636	
Pension and provident funds contributions	2,530	
Audit fees (parent company £51,000)	247	
Emoluments of directors of parent company		
As directors	8	
For management *note 13, page 20*	132	
Payments to past directors and dependants of past directors of parent company	22	
	17,575	
and after crediting:		
Investment income—unquoted	620	

11 Interest paid		
Bank loans, overdrafts and other loans repayable within five years	4,685	
All other loans	3,209	
	7,894	

12 Taxation on profit of year		
United Kingdom—corporation tax at 40%	2,237	
deferred taxation	1,886	
	4,123	
Reduced by—double tax relief	1,522	
overspill relief	—	
	2,601	
Overseas—taxes	5,806	
deferred taxation	476	
	8,883	

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13 Directors' emoluments

	1971	*1970*
	£'000	*£'000*
Chairman	15	*15*
Highest paid director	24	*22*
	Number	*Number*
Up to £2,500	5	*4*
£7,501 to £10,000	1	*1*
£15,001 to £17,500	1	*4*
£17,501 to £20,000	3	—
£20,001 to £22,500	—	*1*
£22,501 to £25,000	1	—

14 Senior employees' emoluments

	Number	*Number*
£10,001 to £12,500	6	*4*
£12,501 to £15,000	2	—

15 Exceptional profits less losses after tax adjustments

		£'000
Profit on sale of fixed assets		819
Prior year adjustments including taxation		353
		1,172
Less:		
Goodwill on acquisition of Bain and Hodge written off	626	
Other items	476	
		1,102
		70

16 Dividends from overseas subsidiaries

The unappropriated profits of overseas subsidiary companies are liable to overseas taxes and United Kingdom taxation, subject to double tax relief, if distributed as dividends. There are exchange control restrictions in certain overseas countries on the remittance of funds to the United Kingdom.

BALANCE SHEET DETAILS

17 Fixed assets

GROUP	TOTAL	FREEHOLD AND LEASEHOLD PROPERTIES	PLANT AND MACHINERY	CYLINDERS	MOTOR VEHICLES	FURNITURE AND FIXTURES
	£'000	£'000	£'000	£'000	£'000	£'000
Cost or valuation 1/10/70	239,201	43,293	127,046	48,369	14,694	5,799
Exchange adjustment	(1,229)	(269)	(482)	(383)	(56)	(39)
New subsidiaries	4,311	2,388	1,692	65	39	127
Capital expenditure	28,206	3,149	15,967	5,109	3,331	650
Demolitions and sales	(8,209)	(1,188)	(3,540)	(371)	(2,807)	(303)
Cost or valuation 30/9/71	262,280	47,373	140,683	52,789	15,201	6,234
Depreciation 1/10/70	110,272	11,214	63,975	24,613	6,787	3,683
Exchange adjustment	(585)	(61)	(248)	(220)	(32)	(24)
New subsidiaries	656	144	412	19	18	63
Provided during year	14,636	1,289	8,148	3,038	1,680	481
Demolitions and sales	(4,991)	(275)	(2,241)	(327)	(1,937)	(211)
Depreciation 30/9/71	119,988	12,311	70,046	27,123	6,516	3,992
Net book value 30/9/71	142,292	35,062	70,637	25,666	8,685	2,242
PARENT						
Cost 1/10/70	113,962	14,365	70,001	19,663	7,827	2,106
Capital expenditure	11,731	481	7,610	2,470	963	207
Transfers from group companies	1,410	221	816	—	48	325
Demolitions and sales	(3,426)	(549)	(1,512)	(241)	(959)	(65)
Cost 30/9/71	123,677	14,418	76,915	21,892	7,879	2,573
Depreciation 1/10/70	53,123	4,526	34,060	9,890	3,216	1,431
Provided during year	6,655	602	3,957	1,170	722	204
Transfers from group companies	785	55	505	—	20	205
Demolitions and sales	(1,808)	(218)	(602)	(187)	(750)	(51)
Depreciation 30/9/71	58,755	4,965	37,920	10,873	3,208	1,789
Net book value 30/9/71	64,922	9,453	38,995	11,019	4,671	784

17 Fixed assets continued

	PARENT	GROUP
	£'000	£'000
Capital expenditure is after deducting UK investment grants	1,757	2,423

Eight overseas companies revalued certain fixed assets in the years 1966 to 1968 and 1970, which increased their then net book values by £4·1 million approximately.

The net book value of leasehold properties at 30th September 1971 included above is:

	PARENT	GROUP
	£'000	£'000
Long term	2,946	5,530
Short term	977	1,864
	3,923	7,394

18 Subsidiary companies

	1971	*1970*
	£'000	*£'000*
Shares at cost and scrip issues at par, less amounts written off	16,679	*33,409*
Amounts owing to parent, including dividends since declared	57,765	*31,806*
	74,444	*65,215*
Less amounts owing by parent, less dividends since declared	4,055	*3,906*
	70,389	*61,309*

19 Investments

	PARENT		GROUP	
	1971	*1970*	1971	*1970*
	£'000	*£'000*	£'000	*£'000*
Shares at cost	785	*931*	2,298	*2,334*
Less amounts written off	109	*109*	129	*140*
	676	*822*	2,169	*2,194*
Add amounts owing to parent or group companies	1,020	*1,023*	2,083	*1,981*
	1,696	*1,845*	4,252	*4,175*
Less amounts owing by parent or group companies	482	*2,277*	1,288	*2,[illegible]*
	1,214	*(432)*	2,964	*[illegible]*
Quoted: market value £6,000 [illegible]	—	—	7	—
Unquoted—equity at directors' valuation	676	*[illegible]*	2,082	*[illegible]*
others at directors' valuation	—	*1*	80	*[illegible]*
	676	*[illegible]*	2,169	*[illegible]*

	PARENT		GROUP	
	1971		1971	
	£'000		£'000	
20 Current assets				
Stock and work in progress *note 2, page 18*	14,619		63,021	
Debtors and payments in advance *note 3, page 18*	23,985		62,950	
Investment grants receivable	2,319		2,936	
Tax reserve certificates	—	—	64	
Deposits at short call	—	—	774	
Cash and bank balances	163		4,121	
	41,086		133,866	
21 Current liabilities and provisions (including bank overdrafts)				
Creditors and accrued liabilities	16,922		44,794	
Bank overdrafts	11,057		17,834	
Taxation—United Kingdom	1,214		2,931	
Overseas	33		6,221	
Proposed final ordinary dividend	4,022		4,022	
	33,248		75,802	
22 Loans—long term				
5¾% Debenture stock 1981/86: secured	8,138		8,138	
6¾% Debenture stock 1985/90: secured	6,630		6,630	
8½% Tonnage Debenture stock 1988: secured	6,000		6,000	
8½% Tonnage Debenture stock 1990: secured	7,500		7,500	
11% Tonnage Debenture stock 1992: secured	10,000	—	10,000	—
7½% Convertible Unsecured loan stock 1987/92	709		709	
6% Loan 1978/80: unsecured	—	—	956	—
7% Debenture stock 1981: secured	—	—	115	—
7% Debenture stock 1986: secured	—	—	175	—
7¼% Debenture stock 1983: secured	—	—	981	
7¼% Debenture stock 1981: secured	—	—	3,333	
7½% Mortgage loan 1986: secured	—	—	416	
7¾% Debenture stock 1979: secured	—	—	803	
7¾% Debenture stock 1984: secured	—	—	199	
7¾% Mortgage loan 1977/78: secured	—	—	129	
8¼% Debenture stock 1981/95: unsecured	—	—	4,512	
*Other Debenture and Mortgage loans	—	—	1,080	
(secured £768,000:				
	38,977		51,676	

*The other debenture and mortgage loans are repayable over the years 1976 to 1997 and carry interest rates varying between nil and 10½%.

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23 Loans—short term

	PARENT		GROUP	
	1971	*1970*	1971	*1970*
	£'000	*£'000*	£'000	*£'000*
Repayable within 1 year	4,518	*6,273*	5,093	*6,789*
2 years	8,092	*667*	9,021	*716*
3 years	302	*1,980*	993	*2,357*
4 years	2,540	*1,283*	2,997	*2,237*
*5 years	10,719	*5,146*	11,409	*6,273*
	26,171	*15,349*	29,513	*18,372*

*Comparative figures of short term loans repayable within five years include £3,045,000 treated as long term loans in 1970.

The parent company short term loans were unsecured. Of the Group short term loans £2,721,000 were secured (*1970: £1,138,000*).

24 Bank loans and overdrafts

Bank loans included within short term loans (see note 23 above) amounted to £24,466,000, which together with the bank overdrafts of £17,834,000 aggregated £42,300,000 for the Group (*1970: £36,105,000*).

25 Share capital

	AUTHORISED	ISSUED	
	1971	1971	*1970*
	£'000	£'000	*£'000*
Ordinary shares of 25p (fully paid)	50,271	50,271	*49,919*
Ordinary shares of 25p (5% paid)	226	11	*10*
Shares of 25p	7,003	—	—
	57,500	50,282	*49,929*
6½% Cumulative preference stock	500	500	*500*
5% Cumulative second preference stock	1,000	1,000	*1,000*
4% Cumulative second preference stock	1,000	1,000	*1,000*
	2,500	2,500	*2,500*

Notes continued on page 27

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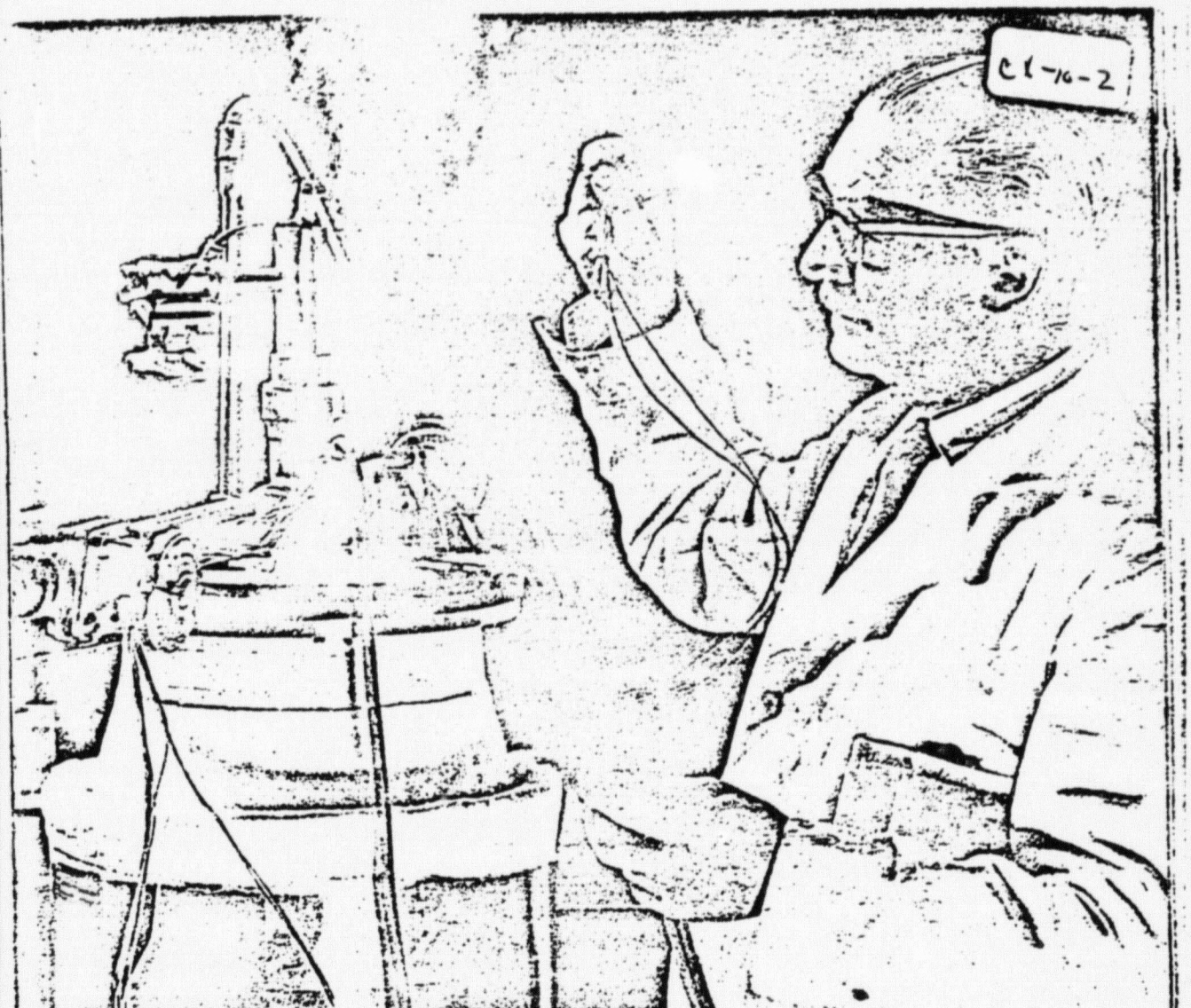
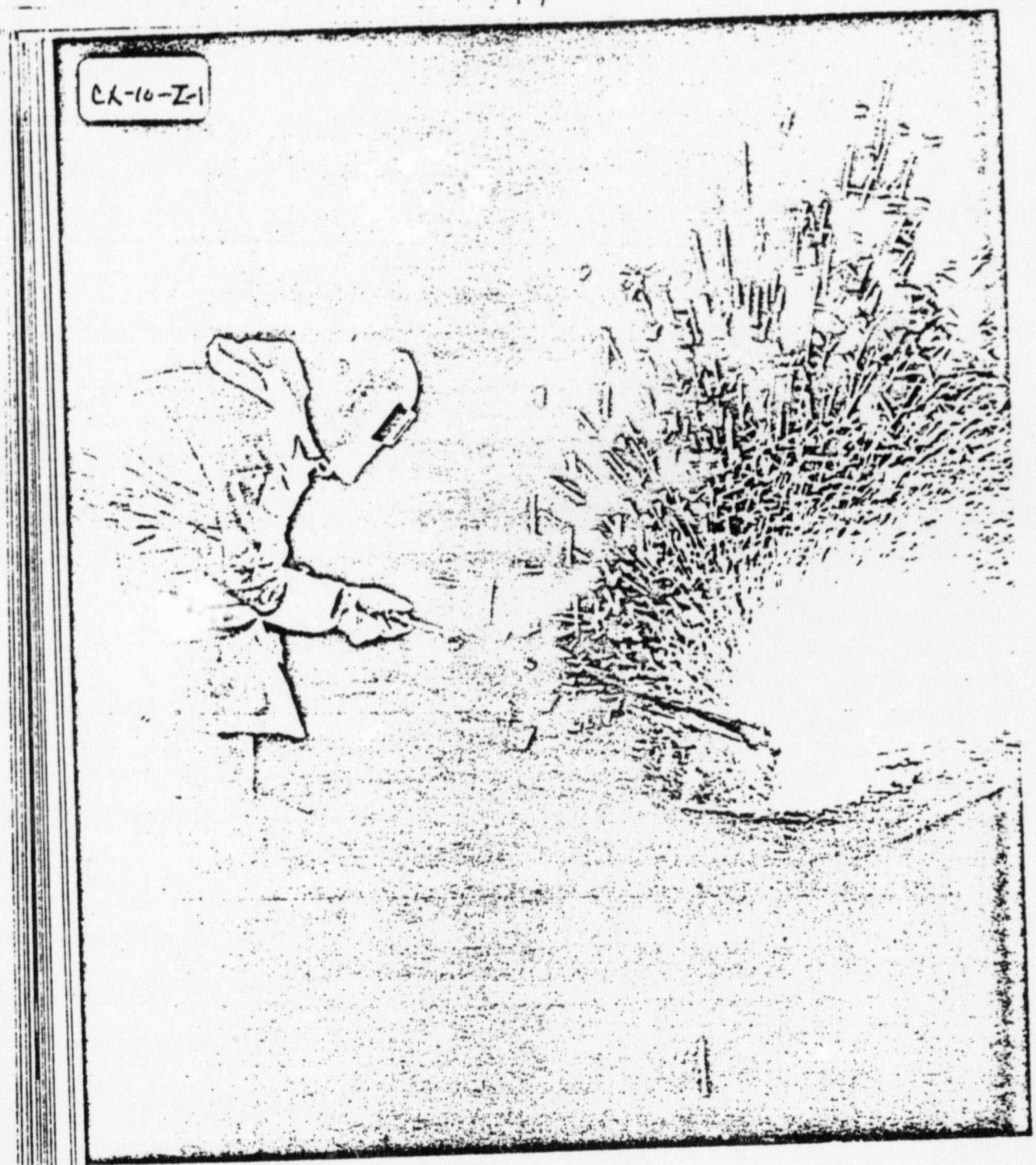


When immersed in liquid helium at minus 269°C certain metals become super-conducting; their electrical resistance is then zero. At BOC Morden, super-conductors are used to make extremely powerful magnets, such as the one inside this helium container; its performance is equivalent to that of a conventional magnet system which would fill a very large room.

A 3700



Scarfing, or removing the surface defects from steel, has been made easier and cheaper by the use of BOC hand scarfing nozzle mix blowpipes.

Notes on Accounts *(continued)*

26 Movements in reserves during year

	PARENT	GROUP
	£'000	£'000
Capital		
Balance at 1st October 1970	2,782	9,352
Retained (part of £2,407,000)	250	344
Others	—	23
	3,032	9,719
Less goodwill on acquisition of subsidiaries	—	2,857
Exchange losses	—	377
	3,032	6,485
Revenue		
Balance at 1st October 1970	10,276	23,232
Retained (part of £2,407,000)	(991)	2,063
Exchange losses	—	(220)
	9,285	25,075
Total reserves	12,317	31,560

The reserves of overseas subsidiary companies are liable to overseas tax and United Kingdom taxation, subject to double tax relief, if distributed as dividends.

27 Capital commitments

	PARENT	GROUP
	£'000	£'000
Projects for expenditure on capital account at 30th September 1971:		
Against which orders had been placed	2,389	7,256
Authorised by the directors but not committed	2,302	5,465
	4,691	12,721

28 Contingent liabilities

The parent company has contingent liabilities amounting to £4,350,000 in respect of bank and other guarantees, the majority on behalf of subsidiary and associated companies. Subsidiary companies have contingent liabilities of £880,000 in respect of guarantees to third parties.

29 Pension fund contributions

Two overseas subsidiary companies are under obligation to contribute to the Trustees of their Pension Funds £120,930 per annum over periods varying from four to seventeen years.

28 Principal Subsidiary and Associated companies in UK and Europe

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The following Group and Associated companies are incorporated in Great Britain and registered in England except where otherwise shown. All are ordinary shareholdings except where indicated.

These companies operate as part of the trading divisions under whose names they are shown. In some cases they represent only a small proportion of the business carried on by those divisions, which trade as part of The British Oxygen Company Limited.

	PERCENTAGE HELD BY:	
	PARENT	SUB-SIDIARIES
Advanced Engineering		
Edwards High Vacuum International Ltd (a)	100	—
Edwards Hochvakuum GmbH (Germany)	—	100
Edwards Alto Vuoto SpA (Italy)	—	100
Saccab SpA (Italy)	—	100
Chemicals		
British Oxygen Chemicals Ltd	100	—
British Oxygen Maydown Ltd	100	—
British Solvent Oils Ltd	100	—
Odda Smelteverk A/S (Norway)	—	100
Food Services		
Ace Refrigeration Ltd	100	—
Bain and Hodge Ltd (b)	100	—
BOC Transhield Ltd	100	—
BOC-Linde Refrigeration Ltd	60	—
J Muirhead Ltd	100	—
Mealstream (UK) Ltd	75	—
Batchelors Ltd (Ireland) (a)	—	100
Heimsyphon GmbH (Germany)	—	100
El Fresno SA (Spain)	50	—
Gases		
Seaflame Company Ltd	51	—
Irish Industrial Gases Ltd (Ireland)	—	75
BOC Northern Ireland Ltd (N Ireland)	—	75
Metals		
Blackwell's Metallurgical Works Ltd	100	—
Deloro Stellite (UK) Ltd (a)	—	100
High Speed Steel Alloys Ltd	100	—
Murex Ltd (a)	100	—
Murex Hispania SA (Spain)	—	85
Welding Products		
British Industrial Gases Ltd	100	—
Murex Welding Processes Ltd (c)	100	—
Hirst Welding Rectifiers Ltd	67	—
Smit Weld NV (Holland)	54	—
BOC Deutschland GmbH (Germany)	100	—
Svenska BOC AB (Sweden) (d)	100	—
BOC-Airco Cryogenic Plant Ltd (e)	50	—
BOC Holdings Ltd	100	—

(a) Includes Preference shares.

(b) Sold prior to 30th September 1971 and not consolidated.

(c) The business formerly carried on by Murex Welding Processes Ltd until 30th September 1971 is now carried on by The British Oxygen Company Ltd, trading under the name of Murex Welding Processes.

(d) Sold prior to 30th September 1971.

(e) Became a wholly-owned subsidiary of The British Oxygen Company Ltd and has changed its name to Cryoplants Ltd since 30th September 1971.

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Principal Subsidiary and Associated companies outside Europe

Unless otherwise stated these companies are held through BOC Holdings Ltd, a wholly-owned subsidiary of The British Oxygen Company Limited.

		PERCENTAGE OF EQUITY	HELD BY
Australia	The Commonwealth Industrial Gases Ltd	59	
Canada	Canadian Oxygen Ltd	100	
	Canadian Helium Ltd	33	
	Edwards High Vacuum (Canada) Ltd	100	Edwards High Vacuum International Ltd
Ceylon	Ceylon Oxygen Ltd	100	
Hong Kong	British Oxygen (Hong Kong) Ltd	100	
	Hong Kong Oxygen & Acetylene Co Ltd	50	British Oxygen (Hong Kong) Ltd
India	Indian Oxygen Ltd	66	
Japan	Nissan-Edwards Shinku K K (f)	50	The British Oxygen Company Limited
Kenya	East African Oxygen Ltd	89	
Malaysia	Malayan Oxygen Sdn Berhad	100	
New Zealand	New Zealand Industrial Gases Ltd	63	
Nigeria	Industrial Gases Ltd	50	
Pakistan	Pakistan Oxygen Ltd	60	
Rhodesia	Rhodesia Oxygen (Pvt) Ltd	100	
Singapore	Singapore Oxygen Pte Ltd	100	
South Africa	African Oxygen Ltd	65	
Tanzania	Tanzania Oxygen Ltd	100	East African Oxygen Ltd
Uganda	Uganda Oxygen Ltd	100	East African Oxygen Ltd
USA	Airco-BOC Cryogenic Plants Corporation (g)	50	The British Oxygen Company Limited
	Edwards High Vacuum Inc	100	Edwards High Vacuum International Ltd
	Leland Industries Inc	100	The British Oxygen Company Limited
	Micro-Aire Corporation (f)	60	The British Oxygen Company Limited
Zambia	Zambia Oxygen Ltd	100	

(f) Acquired since 30th September 1971.
(g) Disposed of since 30th September 1971.

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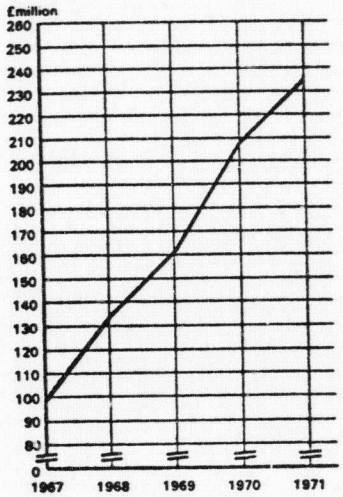
Comparison of results

The British Oxygen Company Limited and subsidiary companies

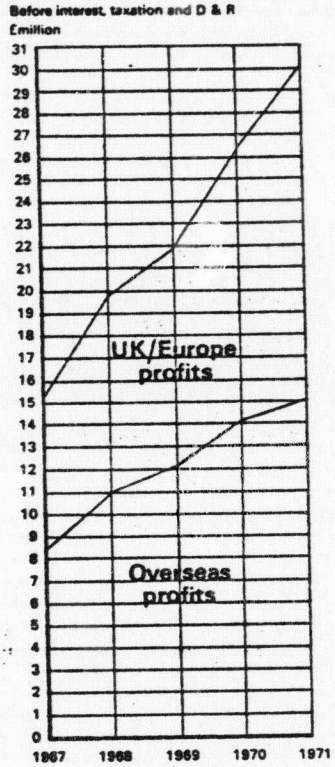
	1967 £'000	1968 £'000	1969 £'000	1970 £'000	1971 £'000
Group sales and profits					
Sales	99,986	134,363	161,251	207,858	234,582
Profit before interest and taxation	13,036	17,533	19,317	23,946	27,619
Less interest	2,876	3,944	4,236	5,431	7,894
Profit before taxation	10,160	13,589	15,081	18,515	19,725
Profit after taxation attributable to ordinary shareholders	4,349	5,696	5,824	7,582	8,370
Exceptional profits less losses after tax	1,556	105	815	350	70
Earnings per fully paid ordinary share (excluding exceptional items and adjusted for scrip and rights issues)	2·58p	3·25p	3·08p	3·80p	4·16p
Capital employed					
Ordinary shareholders' capital and reserves	65,797	78,113	82,531	89,595	89,112
Deferred taxation	6,121	7,157	8,466	8,391	10,436
Preference stockholders' capital	2,500	2,500	2,500	2,500	2,500
Interests of minority shareholders	10,819	13,580	16,503	18,729	20,083
Short and long term loans	34,771	41,562	48,595	59,200	81,189
Capital employed per balance sheet	120,008	142,912	158,595	178,415	203,320
Add Bank overdrafts	18,594	11,187	23,200	22,708	17,834
	138,602	154,099	181,795	201,123	221,154
Return on average capital employed (Based on profit before interest and tax)	10·6%	12·3%	11·5%	12·5%	13·1%
	£'000	£'000	£'000	£'000	£'000
Issued ordinary share capital	41,044	42,771	47,479	49,929	50,282
Ordinary dividend rates	10·0%	10·4%	11·0%	12·0%	12·0%
Adjusted for rights issue	9·8%	10·1%	11·0%	12·0%	12·0%
Number of employees					
United Kingdom	13,200	16,500	18,600	19,400	19,600
Overseas	14,800	15,100	18,500	20,000	20,300

Group Sales

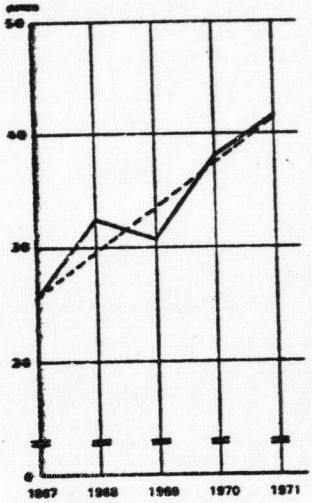


UK/Europe and overseas profits

Before interest, taxation and D & R



Earnings per share



Blue line shows compound annual growth rate: 12.7%

Distribution

Europe	52%
Africa	20%
Australasia	14%
Asia	8%
America	6%

	1971 £'000	FIVE YEARS 1967–1971 £'000
Sources of funds		
Retained profit	3,394	12,745
Depreciation	14,636	59,667
Deferred taxation	2,045	5,954
Internal cash flow	20,075	78,366
Loan capital	21,989	57,738
Bank overdrafts	(4,874)	5,051
Share capital issued	541	14,008
	37,731	155,163
Application of funds		
Expenditure on fixed assets	28,206	102,628
Working capital	5,385	47,842
Investment in Associated companies	1,283	147
Other	2,857	4,546
	37,731	155,163

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Gases Division

Industrial Gases
The supply from some 60 distribution depots covering the UK and the Republic of Ireland, of liquid or compressed gases for welding, cutting, process and space heating, inert atmospheres and a wide range of applications throughout industry. The range of products supplied includes oxygen, nitrogen, argon, acetylene, propane, butane, carbon dioxide, hydrogen, and other fuel gases; shielding gas mixtures for arc welding.
The supply and installation of gas storage and distribution systems on customers' premises.
Ownership and operation of 39 tonnage plants supplying up to 9,530 tons per day of oxygen to steel making and chemical complexes, also nitrogen.
Major pipeline grids deliver oxygen direct to customers' works in the Sheffield, Wolverhampton, Tees-side and Motherwell industrial areas.
Altogether Gases Division operates some 50 air separation plants, and about 50 cylinder filling stations, acetylene plants and propane cylinder filling stations. Also a specialised transport fleet of over 1,300 road vehicles and trains of 100 ton cryogenic rail tank cars.

Special Gases
The supply through the industrial gas distribution depots of:
Ultra high purity atmospheric and rare gases.
Helium in cylinders, tube trailers, small cryogenic vessels and bulk liquid tanks, and liquid hydrogen.
A range of 130 gaseous chemicals.
Tailor-made mixtures of any number of gases including radioactive gases to very high standards of accuracy.
Supply of complete range of equipment for gas handling, purification and safety.

Medical Gases
The supply, from some 30 depots covering the UK, of liquid or compressed gases for anaesthesia, analgesia, oxygen therapy and resuscitation in the medical and dental fields.
Products include: oxygen, nitrous oxide, Entonox, cyclopropane, carbon dioxide, compressed air and helium; oxygen/carbon dioxide and oxygen/helium mixtures, special mixtures to customers' specification.

Food Processes
Liquid nitrogen deep freezing, cooling and transport refrigeration systems. Systems using inert gases to increase shelf life and improve quality in packaged foodstuffs.

Industrial Services
Design and installation of compressed natural gas, liquid natural gas and liquid petroleum gas plant including burners, controls and ancillaries.
Gas ballasting and simulated natural gas satellite stations.
Liquid petroleum gas/air mix plant, natural gas pressure reduction stations, control and conditioning equipment.
Bulk transportation of liquid fuel gases and specialised chemicals.

Mobile installation, maintenance and overhaul services to industrial suppliers and users of mechanical process and chemical plant, including all associated electrical components, instrumentation, pipework, specialised welding and ancillaries.

Customer Installation Engineering
Design, supply, installation and maintenance of specialist pipelines and bulk storage facilities for industry, commerce and hospitals; covering all industrial, medical, and rare gases, compressed air, also vacuum, cryogenics; specialised air conditioning and heating systems.

24 hour industrial and medical maintenance and emergency breakdown services provided throughout the UK as well as planned preventive maintenance.

Seaflame Company Ltd
(Joint venture with the Donald Cameron Group)
Domestic and industrial conversions for use of natural gas together with associated services and maintenance activities.

Welding Products Division

Light Industrial Equipment
Manufacturers of gas welding, cutting, scarfing and flame hardening equipment, nozzles, regulators, gauges, fine adjustment valves and control panels.
Suppliers of welders' accessories, gas hose and fittings, thermic boring and air propane equipment, gas welding rods and fluxes. The installation and maintenance of gas manifolds and pipelines.

Cutting Machines and Steelworks Equipment
Manufacturers of a wide range of gas, plasma and laser cutting machines from portable models to ratio and numerically controlled cross carriage machines, also heavy cutting rigs, and suppliers of hot and cold scarfing machines for steelworks.

Manual Arc Welding Equipment and Consumables
Manufacturers of transformer, rectifier and generator welding power units and QUASI-ARC and MUREX brands of mild steel and special electrodes. Suppliers of accessories and ancillary equipment for arc welding.

Semi-Automatic Arc Welding Equipment and Consumables
Manufacturers of MIG (metal inert gas), MAG (metal active gas), TIG (tungsten inert gas) arc welding equipment, plasma welding equipment and power units, associated welding wires and tubular electrodes.

Automatic Arc Welding
Manufacturers of integrated automatic welding equipment for submerged arc, FUSARC and MIG processes, and associated welding wires, electrodes and powders.
Suppliers of booms, roller beds and other manipulating equipment and specialist installations.

Cryoplants Limited

Design, engineering, contracting and fabrication of low temperature process plants; systems for treatment, storage and distribution of industrial gases; stainless steel and aluminium pressure vessels, tanks and piping.

Food Services Division

Ace Refrigeration Ltd
Wholesale distribution of a variety of domestic and commercial deep freezers.

Batchelors Ltd
Processing, canning and bottling of food and beverages.

BOC Transhield Ltd
Food distribution contracts. Includes specially equipped vehicles.

Comprising:
G L Baker (Transport) Ltd

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M A Keenan & Sons Ltd
BOC Transhield depots provide a UK-wide distribution service for Marks & Spencer.

King Harry Foods
Frozen food development unit specializing in pre-cooked entrées.

J Muirhead Ltd
Marketing and distributing frozen foods and canned goods under the 4Fs and Green Isle labels and canned fruit juices from the Vida range.

Winchester Frozen Foods Ltd
Chain of retail cash and carry outlets selling frozen food and deep freezers. Supply and distribution of frozen foods to the catering and domestic markets.

BOC-Linde Refrigeration Ltd (Joint venture with Linde AG of Germany)
Commercial and industrial mechanical refrigeration and deep freeze equipment including retail display cabinets.

El Fresno SA (Joint venture with SA Conservera Extremena of Spain)
Processing and marketing of frozen foods under the Vida brand in Spain and also for export.

Consumer Products Division

Sparklets
Sparklets soda syphons and bulbs, drink concentrates, 'Beertap', 'Iceberg' icebowl, cream whippers and bulbs, tubes for fire extinguishers.
Oxynhaler (a pocket oxygen dispenser for sufferers of cardiac and chest complaints).

Heimsyphon GmbH
Soda syphons and bulbs, drink concentrates, cream whippers, beer dispensing equipment for home use.

Leland Industries Inc.
Marketing of UK and Heimsyphon Consumer Products range in USA.

Mealstream (UK) Ltd
Micro-Aire combined micro-wave and hot air electric ovens for the catering industry.

Micro-Aire Corporation
Micro-Aire electric ovens for the catering industry in the United States.

Chemicals Division

British Oxygen Chemicals Ltd
Melamine. Tall oil rosin and fatty acids—used in paper-making, paints, plastics and industrial soaps. Pressure sensitive adhesive emulsions. Polyvinyl pyrrolidone—used in cosmetics and toilet requisites. Agents for dicyandiamide, benzoguanamine and sucrose benzoate.

British Solvent Oils Ltd
Specialised oil products including mould release oils.

British Oxygen Maydown Ltd
Acetylene for neoprene manufacture.

Odda Smelteverk A/S
Calcium carbide and derivatives—dicyandiamide and calcium cyanamide.

Metals Division

Murex Ltd
Alloys and chemical derivatives of a range of metals, including molybdenum, tungsten, tantalum, niobium, vanadium. Refractory metals in powder, wrought and fabricated form. Tungsten carbide and hard metal powders. Hard metal products, including tools, tips and dies. Sintered magnets. Melted alloys. Separation of ores. Ore conversions. Thermit compounds.

Prolite Ltd
Wide range of hard metal products, principally to the metal cutting, shaping and forming industries.

Thermit Welding (Gt. Britain) Ltd (associated company)
Compounds and equipment for thermit welding. Rail welding and repair by thermit welding process.

Murex Hispania S.A.
A range of hard metal products, especially dies and tips.

Termoligas Metalurgicas S.A. (Associated Company)
Ferro tungsten, ferro molybdenum, ferro vanadium, ferro titanium and ferro manganese.

Deloro Stellite (UK) Ltd and Stridsberg-Deloro AB
Components in cast 'Stellite'. Surgical implants. Hard facing rods. Comprehensive service in 'Stellite' coating.

High Speed Steel Alloys Ltd
Inorganic chemicals based on tungsten, molybdenum, vanadium. Ferro alloys. Tungsten metal and carbide powders.

Blackwell's Metallurgical Works Ltd
Aluminium hardeners and other melted alloys.

BOC Minerals
Purchasing and trading in mineral ores, metals and metallic salts.

Advanced Engineering Division

Medical & Aviation Equipment
Manufacturers and suppliers of anaesthetic, analgesic and oxygen therapy equipment, respirators and resuscitators, medical pipeline systems, dental and obstetric apparatus, intensive care and inhalation therapy equipment, electronic monitoring equipment.
Aviation equipment covers liquid and gaseous oxygen systems with associated breathing equipment for crew and passengers of military and civil aircraft. Liquid and gaseous production plants, storage tanks, dispensing equipment. Liquid nitrogen airborne equipment for fuel tank inerting, liquid/gas evaporative cooling, etc.

Cryoproducts
Superinsulated dewars and accessories for the storage and dispensing of liquid nitrogen, liquid air, liquid natural gas and liquid helium. Equipment for cryogenic liquid production. Helium gas recovery units and purification systems.

SACCAB SpA
Anaesthetic equipment and accessories, medical pipelines, inhalation therapy equipment, medical electronics for intensive care and diagnostics, heart pacemakers, emergency ambulance equipment, lung ventilators. Nitrous oxide.

Edwards High Vacuum International
Vacuum processing plant, thin film deposition systems, heat treatment and melting furnaces, freeze dryers and special pumping systems, contract vacuum brazing and thin film coatings, vacuum pumps and accessories, mechanical pumps, vapour diffusion pumps and ultra high vacuum pumps and systems. Vacuum gauges, monitoring and control equipment, mass spectrometers and accelerated ion-beam devices.

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34 Directors of principal Group companies outside the UK

CX-10-29

Australasia

THE COMMONWEALTH INDUSTRIAL GASES LTD

Chairman
K. O. Humphreys
Deputy Chairman
R. R. Law Smith
Managing Director
J. A. Davidson
Directors
E. D. Edmundson — A. S. Grimwade
J. S. Hutchison — Sir Richard Randall
L. E. Smith — W. R. D. Stevenson
A. W. Stewart

NEW ZEALAND INDUSTRIAL GASES LTD

Chairman
T. G. Hull
Managing Director
E. D. Edmundson
Directors
W. F. Airey — W. G. Anderson
D. G. E. Brown — J. A. Davidson
R. McR. Gimblinton — R. C. Macdonald
R. S. V. Simpson — L. E. Smith

Africa

AFRICAN OXYGEN LTD

Chairman
I. Mackenzie
Group Managing Director
J. B. Sutherland
Directors
C. L. F. Boutlenhagen — W. L. Campbell-Pitt
A. J. du Toit — I. S. Haggie
I. G. Halliday — A. J. J. Wessels
W. P. Rousseau

EAST AFRICAN OXYGEN LTD

Chairman
I. S. Ednie
Deputy Chairman
M. W. Hasley
Managing Director
R. J. M. Muller
Directors
R. C. Hesketh-Jones — C. H. Malavu
D. A. Ormsi

RHODESIA OXYGEN (PVT) LTD

Chairman
G. C. V. Cappen
Director/General Manager
P. B. Thame
Directors
D. H. Cummings — J. B. Sutherland
C. H. Taggit — C. J. Voss
W. R. Whaley

ZAMBIA OXYGEN LTD

Chairman
R. C. Hesketh-Jones
Director/General Manager
D. J. Woodworth
Directors
A. W. Cobb — K. D. Moore
J. S. Hutchison

Asia

CEYLON OXYGEN LTD

Chairman
D. E. Mathias
Director/General Manager
G. Wilby
Directors
S. Cumaraswamy — R. C. Hesketh-Jones
J. D. Hicks — S. K. D. Jayamanne

BRITISH OXYGEN (HONG KONG) LTD

Chairman
Sir Douglas Clague
Managing Director
R. Beynon
Directors
J. S. Hutchison — G. M. Macwhinnie

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Asia

INDIAN OXYGEN LTD

Chairman
A. K. Sen
Managing Director
K. Hartley
Directors
P. C. Barr — H. Ghosh
K. Gopalakrishna — R. C. Hesketh-Jones
A. K. Mukerji — L. E. Smith
M. A. Sreenivasan — S. R. Stephens
V. N. Swamy

MALAYAN OXYGEN SDN BERHAD and SINGAPORE OXYGEN PTE LTD

Chairman and Managing Director
C. J. Boyles
Directors
D. Arnott — D. F. Barrington Baker
D. O. bin Talib — P. G. Grundy
R. C. Hesketh-Jones — J. S. Hutchison
D. Nai-Wai Lee — L. E. Smith

PAKISTAN OXYGEN LTD

Chairman
H. I. Rahimtoola
Managing Director
P. J. R. Southgate
Directors
J. F. C. Gallaher — R. C. Hesketh-Jones
Khan F. M. Khan — M. Nasim Khan
J. D. LeVaillant — M. A. Raza

Europe

BATCHELORS LTD (IRELAND)

Chairman
D. W. E. Stafferton
Managing Director
P. J. Loughrey
Directors
M. J. Byrne — J. D. Dickie
D. D. Frame — J. Greene
P. W. Harris — P. Laister
P. J. Loughrey — W. H. Magill
D. Melvin

IRISH INDUSTRIAL GASES LTD (IRELAND)

Chairman
D. D. Frame
Managing Director
M. J. Garms
Directors
S. Warnock Aitken (General Manager)
Samuel W. Aitken — S. W. Jack
D. W. N. Pitts — N. F. J. Reckitt
J. M. Williams

ODDA SMELTEVERK A/S (NORWAY)

Chairman
P. Stabell
Managing Director
G. Evertsen
Directors
A. Bratt — P. Laister
A. Rokne — D. R. Scarffe

SMIT WELD NV (HOLLAND)

Chairman
P. Laister
Vice Chairman
D. de Gooyer
Directors
P. H. Groeneveld — J. Hermans
D. Melvin — N. F. J. Reckitt

North America

CANADIAN OXYGEN LTD

Chairman
H. M. Turner
President
J. A. Perham
Directors
J. P. Carriere — A. R. Dow
R. C. Hesketh-Jones — J. S. Hutchison
W. K. Macleod — L. E. Smith
M. Tanenbaum

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Shareholders' and Stockholders' Calendar: Dividend and Interest Payments

Ordinary shares	Interim announced June paid September Final proposed December paid March
Preference stocks	Paid half yearly, 30 June, 31 December
5¾% and 6¾% Debenture stocks	Paid half yearly, 15 May, 15 November
8½% and 11% Tonnage Debenture stocks	Paid half yearly, 15 June, 15 December
7½% Convertible Unsecured Loan stock	Paid half yearly, 15 July, 15 January

Conversion date	*Number of Ordinary shares of 25p for each £100 stock converted*
31 March 1972	185

Announcement of Group results

Three months' results	March
Half year's results	June
Nine months' results	September
Year's results	December
Report and Accounts	February

Capital Gains Tax

For capital gains tax purposes the market values of BOC Ordinary shares, Preference stocks and Loan stocks at 6 April 1965 were:

Ordinary shares of 25p	45.3125p
6½% Cum pref stock £1 units	98.75p
5% Cum 2nd pref stock £1 units	72.5p
4% Cum 2nd pref stock £1 units	56.25p
5¾% Debenture stock 1981/86	£87
6¾% Debenture stock 1985/90:	
fully paid	£99½
£50 paid	£51½

The Company is not a close company within the meaning of the Income and Corporation Taxes Act 1970.

Pictures by BOC Staff Photographer Derek Logsdon
Printed by St. Clements Foss & Cross Ltd., London

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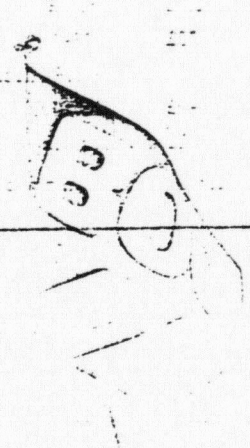

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British Oxygen Company Report and Accounts 1972

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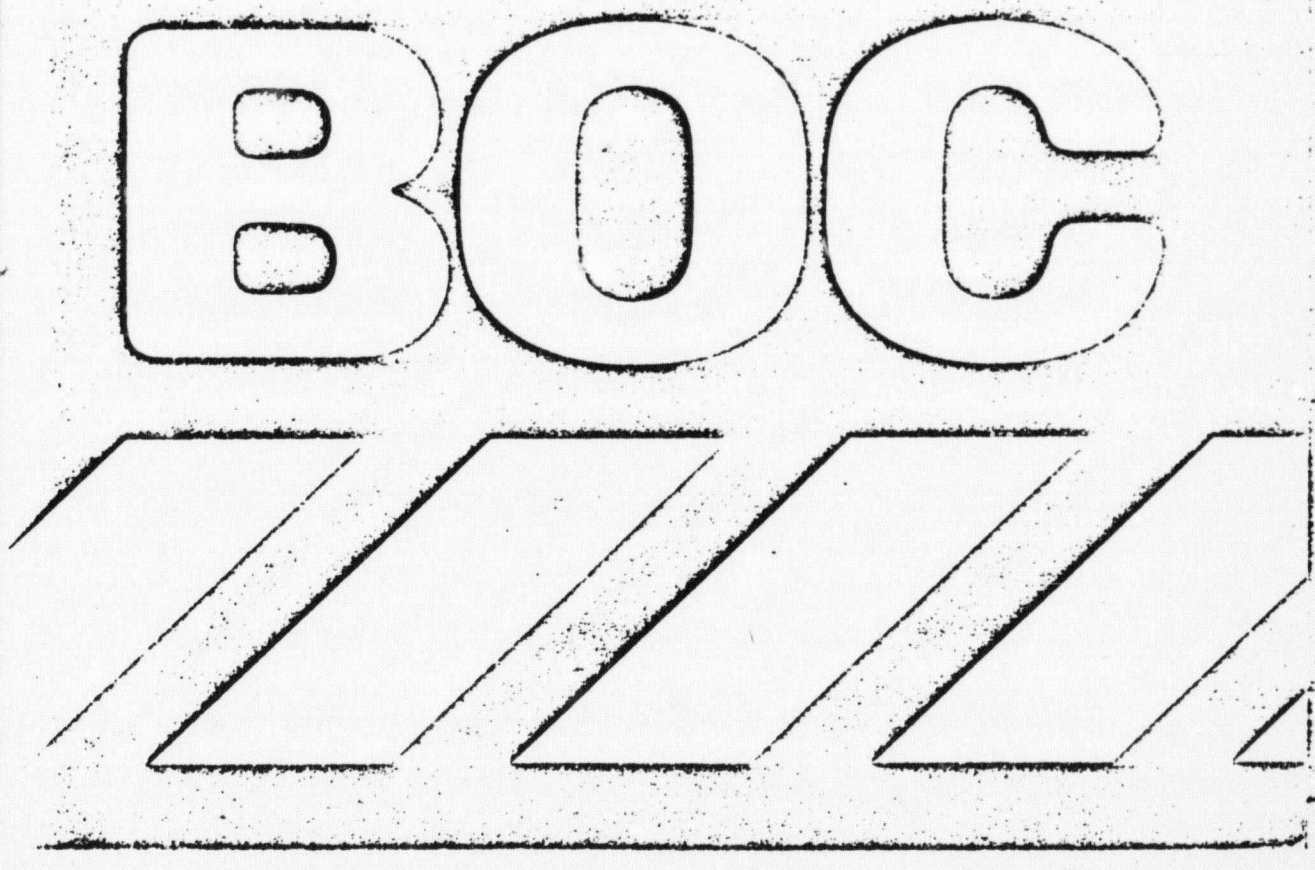

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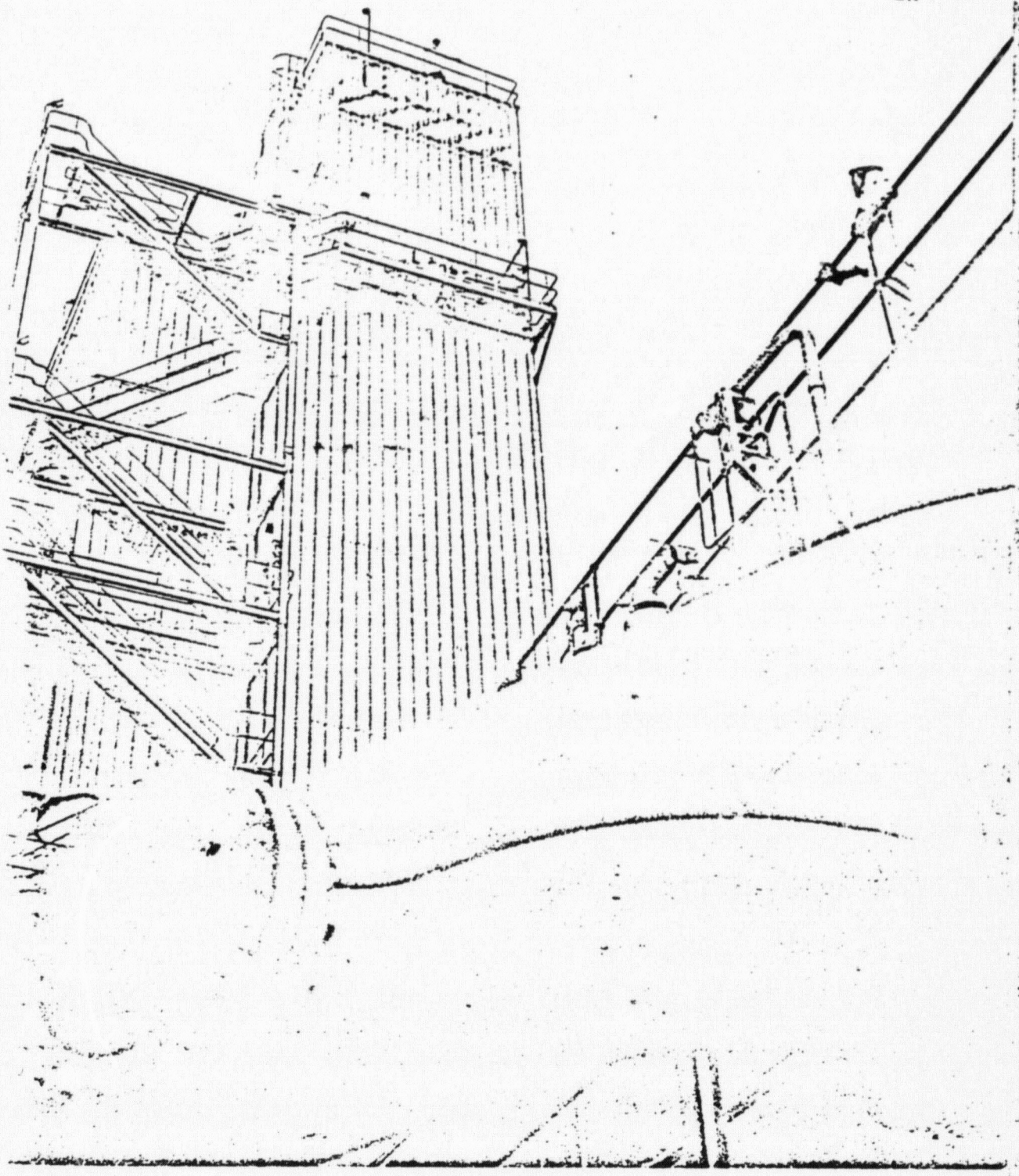
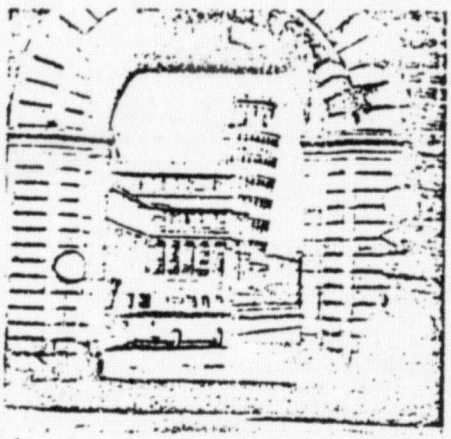


The largest air separation plant in Europe. BOC's 'super plant' at Widnes, Lancashire, produces liquid oxygen and nitrogen. It has a capacity of 1400 tons a day.

A 3714



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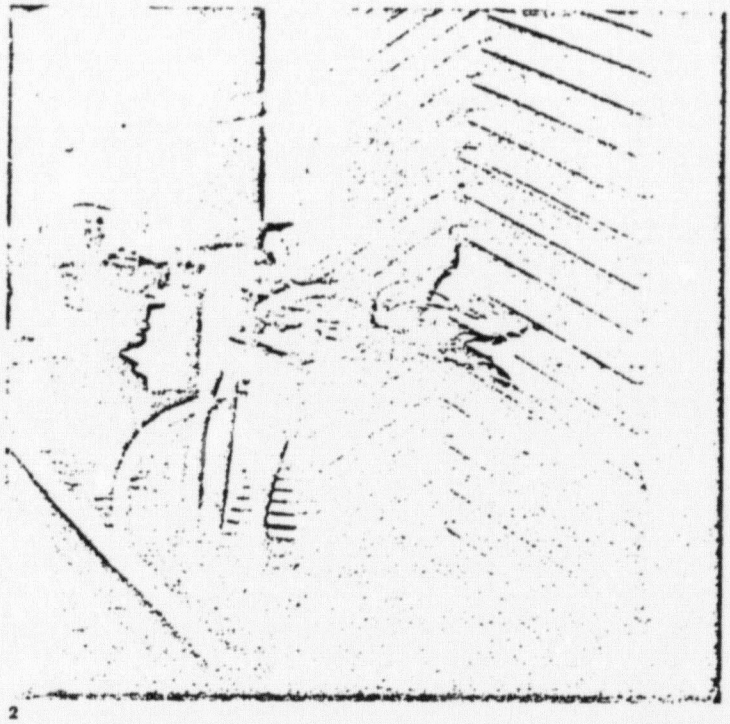

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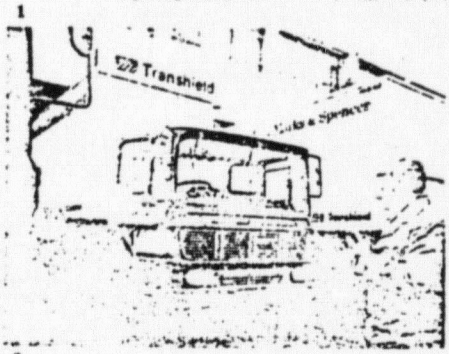

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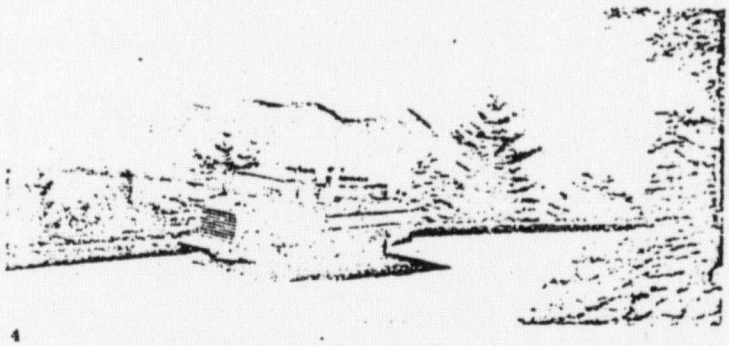

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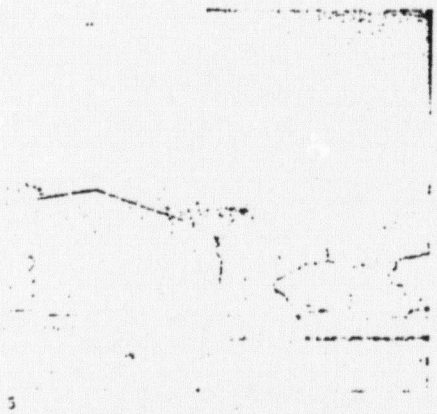

5

1 Saccab delivering medical supplies at Pisa.

2 BOC flame hardening equipment at Fairbairn Lawson, Leeds.

3 BOC Transfield [illegible] delivers vehicles to [illegible] Depot.

4 Gas Plan Oxygen [illegible] delivers to Bolton [illegible]

5 [illegible]

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ex-11-D

	1972	
Sales	£[illegible]	[illegible]
Group trading profit		
UK and Europe	17 476 372	*14 921 2[illegible]*
Overseas	16 054 178	*15 527 996*
	£33 530 550	*£30 449 224*
Disposable profit		
Dividend and shareholders' income tax	6 226 614	*6 155 067*
Retained profit	4 920 434	*2 569 598*
	£11 147 048	*£8 724 665*
Average capital employed	£229 487 062	*£211 756 541*
Return on capital	13·5%	*13·2%*
Earnings per 25p share	5·03p	*4·46p*
Ordinary dividend per 25p share	3p	*3p*
Distribution of Sales		
Europe	54%	[illegible]
Africa	17%	[illegible]
Australasia	15%	[illegible]
Asia	7%	[illegible]
America	7%	[illegible]
	100%	

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Directors' Report and Accounts 1972

PAGE	CONTENTS
3	Group results at a glance
5	Notice of meeting
6	Directors and management
7	Chairman's statement
9	Report of the Directors
14	Report of the Auditors
15	Accounting principles
16	Consolidated profit and loss account
17	Balance sheets
18	Notes on accounts
26	Principal subsidiary and associated companies
28	Group directors outside the UK
30	Comparison of results 1968-72
32	BOC principal products and services
36	Shareholders' information and analysis of shareholdings

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Ex-11-F

Notice of meeting

NOTICE IS HEREBY GIVEN that the eighty-seventh Annual General Meeting of The British Oxygen Company Limited will be held at the Confederation of British Industry, Council Chamber, 21 Tothill Street, London SW1, on Tuesday 27th February 1973 at 11.30 a.m.

1 To receive and consider the statement of accounts and the reports of the Directors and Auditors thereon and to declare a dividend.

2 To elect Directors.

3 To authorise the Directors to fix the remuneration of the Auditors.

4 To transact any other business that may be transacted at an Annual General Meeting.

By order of the Board
C A B Leslie
Secretary

NOTES

1 Only holders of Ordinary shares are entitled to attend or be represented at the meeting. A member entitled to attend and vote may appoint one or more proxies to attend and vote instead of him. A proxy need not be a member.

2 No Director has a service contract which does not expire, or which is not determinable by the Company without payment of compensation, within one year.

3 Warrants will be posted on 8th March if the proposed dividend is approved.

Registered Office:
Hammersmith House
London W6
2nd February 1973

A Proxy Card is enclosed for holders of Ordinary shares

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CX-11-G

The British Oxygen Company Limited

Board of Directors

Chairman	L E Smith
Vice Chairman	Sir Geoffrey Eley CBE
	Sir John Cowley GC KBE CB
	Lord Elworthy GCB CBE DSO MVO DFC AFC
	I J Fraser CBE MC
	Sir Owen Wansbrough-Jones KBE CB
Managing Directors	R C Hesketh-Jones
	P Laister
	J M Williams

Management

TRADING DIVISIONS		
Advanced Engineering	Chief Executive	A I A Ray
Chemicals	Chief Executive	D R Scarffe
Food Services	Chief Executive	D W E Stafferton
Gases	Chief Executive	D W N Pitts
Metals	Chief Executive	G Winfield
Welding Products	Chief Executive	P G Bosonnet
OTHER TRADING UNITS		
BOC Transhield Ltd	Managing Director	R W Broome
Cryoplants Ltd	Managing Director	K Parfitt
CENTRAL SERVICES		
	Head of Central Services	B W Mills
	Head of Support Staff	D Melvin
GROUP HEADQUARTERS		
	Director of Group Strategy	M J Shanks
	Chief Adviser—Finance	L R Dingle
	Chief Adviser—Public Affairs	A Eden-Green
	Int'l. Welding Coordinator	N F J Reckitt
	Company Secretary	C A B Leslie

The only change in Chief Executives during the year under review was that Mr A F Kadakis resigned to return home to USA.

Since 1st October 1972, Mr Reckitt has taken up a special assignment in coordinating our international welding businesses and Mr Bosonnet has succeeded him as Chief Executive of Welding Products Division. Other important changes were in the organisation and staffing of Group Headquarters, the most significant being the establishment of a Group Strategy Office and a rearrangement of Central and support services. Composition and membership of the Board were not affected.

Senior management changes since 1st January 1973 are shown above.

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EX-11-H

Chairman's Statement

Our last Annual General Meeting closed with a brief, simple statement from Mr. Hunt [illegible] of his retirement. This was a typical reflection of the modest man who had devoted his entire energies and abilities to BOC during 21 years of chairmanship. Everybody connected with BOC will wish him many years of happy retirement.

The Report of the Directors reviews the results for the year ended 30th September 1972. There is satisfaction, but no complacency, in having maintained for the past five years an annual growth rate of 13% in earnings per share. There have been two main contributory factors to that record: the improved return on capital employed and the increased gearing of the Group's capital structure. My views on both factors—and their relevance to the future—are given below. But first I would like to place the record of the last five years in an historical context.

The early and mid-'sixties saw BOC beset with many difficulties at home. In particular, the advent of oxygen requirements on a 'tonnage' scale posed special problems for us which were only finally resolved by two vital and far-seeing decisions. The first was to invest large sums at initially small returns in 'tonnage' plants, and the second was to scrap our existing conventional production plant. These decisions had to be made at a time when our ability to compete with an agile newcomer was impaired by the undertakings required from us by the 1956 Monopolies Commission Report.

Looking back, it is no surprise that management was overstrained, a situation which no doubt contributed to the collapse in health of one Managing Director and to the early death of two of his successors. The main feature sustaining the Group during this period was the progress made in our Overseas companies. Yet, even then, it was foreseen that by the early 'seventies the rapid rate of overseas growth might be expected to diminish under pressure from competition, economic nationalism and other factors.

In facing up to these difficulties, the foundations were laid which made possible the improved profit record of recent years. These included: new management devoted to the concept of decentralised profit responsibility; new investment to modernise our production and distribution capacity; new agreements which, with the help of the Unions, have placed our labour relations on to a new and better footing; new, reinvigorated, attitudes towards our markets and those who inhabit them.

Today, whilst I certainly do not claim that all our problems have been solved, it is fair to point to the record of the last five years as an indication that substantial progress has been made.

[illegible] growth over [illegible] the returns earned on the aggregate capital [illegible] overseas remain good. At home, there has been [illegible] improvement in the returns earned in Gases, Engineering, Advanced Engineering and Transhield. These improvements came mainly from reduced costs arising from increased efficiency and new investment. For the bulk of our products, we did not increase prices and demand showed a moderate improvement only in the last month or two of the year.

In Welding and in Metals the returns on capital employed are still not satisfactory. In both divisions, market demand and prices continued to be depressed throughout 1972. The opportunity was taken to overhaul our methods of production and marketing as well as strengthening and restructuring management. The process has been expensive but both divisions are now in much better shape to take advantage of improvements in the market when they come.

I referred earlier to a second factor in the improved earnings per share, i.e. higher gearing. Particularly with regard to industrial gases, still much the largest part of the Group's business, there are many factors which, when taken together, make it entirely appropriate to finance a high proportion of the capital expenditure with loan money rather than equity capital. These factors include the relative stability of demand, the popularity of long-term contracts, the wide spread of markets served and the severe technological, financial and marketing hurdles which a newcomer to the industry has to overcome. In our tonnage business, where there is the additional factor of minimum payment clauses, the situation has given rise to the issue of our tonnage debentures. The case for financing the remainder of the industrial gas business with substantial loan capital is almost as strong. All in all, your Board is satisfied that the present gearing, or thereabouts, can and should be maintained in the best interests of the shareholders.

So, given reasonably stable economic conditions, we face the immediate future with confidence. There is still ample scope for improving the returns earned in the existing businesses, particularly at home, and our managers are determined to exploit it. In addition, and at the same time, we are actively seeking areas of high growth, either geographically (and particularly within EEC) or by product, so that our current rate of profit expansion shall be sustained and increased over the next decade.

If we are to succeed in our plans, we shall need [illegible] to maintain our current profit growth and our current level of capital gearing. In addition, we may need to

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Chairman's statement

plough back into the business rather more of our profits than has been done in recent years when the cover for dividend has not been as high as we would have wished. The increased profits for 1972 have already helped in that direction and it is likely that further help will be provided by the tax changes due in April 1973 when the Imputation System comes into effect.

No review of the record of the last five years could be complete without reference to the most important factor of all, the people involved. The growth in the size and complexity of the Group has made heavy demands on the skill, resourcefulness and loyalty of our management everywhere, most particularly of the Managing Directors and Chief Executives, home and overseas. Behind them, and working with them, there are another 40 000 people each of whom has made his or her contribution. All have invested their energies and careers in BOC. In offering them thanks on behalf of the Board, I also promise them our best efforts towards the realisation of their brightest hope for a successful future: a profitable and expanding BOC Group.

L E Smith

London
2nd February 1973

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Report of the Directors

The Directors submit their report and statement of accounts for the year ended 30th September 1972.
The Group profit and loss account is summarised thus:

		£'000
Group profit attributable to parent Company		10 325
Less Extraordinary items (net), after tax		110
		10 215
Add Transitional and non-recurring credit for notional Advance Corporation Tax		902
Disposable profit		11 147
Dividends already paid (gross):		
Preference	122	
Ordinary interim of 1p per share	2 035	
		2 157
Directors recommend:		
Final ordinary dividend of 2p per share (gross)	4 070	
Profit retained	4 920	
		8 990
		11 147

Profits and trading

Compared with the previous year, sales increased by 7·7%, Group trading profit by 10·1% and earnings per share by 12·8%. The growth rate of earnings per share over the past five years has been 13% p.a.

Dividend

With regard to dividend, our thinking must be ruled by the present efforts of Government and both sides of industry to agree a programme of restraint in the growth of incomes and prices. The Directors are therefore recommending the same total rate of Ordinary dividend as in the previous year.

Shareholders will have noticed that the interim dividend previously announced to be payable in September 1972 was deferred for a few days into October. The reason was to secure certain non-recurring tax benefits available under the transitional arrangements for introducing the new system of corporation tax on 6th April 1973.

Taxation

Our high level of capital expenditure has enabled us for some years to enjoy substantial capital allowances to offset against tax. As a result, actual tax paid has been a small proportion of the tax charge and substantial sums have been transferred to tax equalisation account. The 1972 Finance Act provisions, with higher depreciation allowances, will maintain this situation.

It is not expected that the introduction of VAT will materially affect the Company other than by a minor increase in the value of stocks held to allow for the VAT additive.

Accounting changes

Instead of including only the dividends received from associated companies (i.e. those companies in which BOC's holding was 50% or less) we have this year consolidated BOC's share in profits, where material. Also adjustments of prior year tax have been made in the tax charge for the year instead of including them in Extraordinary items as in the past. Both changes follow the recommendations of the Institute of Chartered Accountants and all comparable figures have been altered accordingly.

General comments on the year

Signs of the hoped for economic recovery in the UK came only late in the year. Even then the upturn was hesitant and patchy. In addition, BOC inevitably felt the backlash of some of the industrial relations problems that beset other industries although we ourselves continued to enjoy improved relationships—the result of genuine and progressive efforts between management, employees and their Unions.

In the circumstances the UK results were gratifying, not least because it was a difficult year for many of the overseas companies.

The improvement at home reflects, especially in Gases Division, some of the benefits of the heavy investment programme of recent years. Except for tonnage opportunities and the continuing need to replace and update our distribution system, no major capital requirement is planned in Gases for the next few years. Nor is any major investment planned in our other activities, though we are well placed to expand by merger or acquisition if the right opportunity arises.

We have no doubt that the fundamental changes made in BOC's organisation in recent years have contributed to the improved profitability. Our philosophy has been to divide the Company into a number of profit centres and to do everything possible to make every employee aware that he has a personal share of responsibility for his own section's profits. This has led to a noticeable increase in

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10 Report of the Directors

the energy, enterprise and acceptance of responsibility by employees at all levels. It has also made their jobs more interesting.

We share the general concern about inflation and gladly supported the CBI's voluntary restraint on price increases. This support involved some sacrifice on our part but the curbing of inflation is an overriding consideration in both the national and our shareholders' interests.

Europe: We welcome the accession of the UK to the EEC and believe there will be some substantial benefits to BOC though they will mainly be in the long-term. Meanwhile, our planning for fuller participation in this enlarged market has been intensified.

Gases Division

The low level of activity in British industrial production, coupled with highly competitive trading conditions, brought little growth to the Division's business.

Fortunately, these adverse factors were more than compensated for by continued improvement in the Division's cost performance. New large and efficient plants were brought into service on time and at forecast cost and performance, while the process of retirement of older less economic units continued.

New 730 tons a day oxygen plants were commissioned during the year at both Middlesbrough and Scunthorpe and also a hydrogen plant for Pilkington Brothers Limited at St Helens. Including these, and the 1 400 tons a day plant at Widnes which produces liquid products for the merchant market, there are now 40 BOC tonnage plants in the UK, with a total product capability of more than 17 000 tons a day.

Further reductions in operating costs were also made possible by the use of improved practices and methods. The Division is beginning to enjoy the benefits of the significant injection of capital made in recent years.

Our new venture into the cylinder carbon dioxide market has started particularly well in the UK and we have acquired two small CO_2 companies in Denmark, A/S Kulsyre and Tørisfabriken 'Union' and Nordisk Kulsyre-fabrik A/S. We expect continuing development in both markets.

Progress also continued in Ireland and plant with an ultimate capability of 200 tons a day of oxygen/nitrogen is now nearing completion in Dublin. As in the UK there were significant reductions in some prices, particularly for large consumers.

We have been energetically developing new applications for industrial gases. These efforts have been well rewarded and it is our intention to intensify them further.

Cryoplants Ltd

Cryoplants' role is also to deliver plant to Gases Division on time and within the funds needed and at the forecast cost. This was achieved, which is no mean feat in the case of large and complex tonnage plant.

As regards trading outside the Group, it was a difficult year with a continuing decline in worldwide capital investment and relatively few orders being available to us. Nevertheless, we are currently executing contracts in Brazil, Finland, Australia, South Africa, US and Algeria as well as in the UK.

We are particularly pleased to have won four of the five contracts awarded by the UK Gas Council for peak-shaving liquid natural gas plants, the result of our early development of the mixed refrigerant cycle.

Welding Products Division

The recession in the UK and Continental engineering industries continued throughout the year. In spite of this divisional profits improved, largely due to increased efficiency resulting from the progressive reorganisation carried through during recent years.

The Division has now been grouped into a number of self-contained profit accountable product groups, each of which has its own special production and marketing problems. During the year the arc equipment product group moved to a new factory (also its headquarters) on the Milton Keynes industrial estate and the concentration of the gas equipment business at Skelmersdale in Lancashire, recently announced, will complete the pattern. Other groups in the Division are arc consumables and workshop supplies at Waltham Cross, automatic welding and positioning equipment at Knowsley and cutting machines at Gateshead.

The reorganisations ensure that the division is in good shape to take advantage of any revival in the UK economy and to meet the challenge of the EEC markets, for which there has been much preparation.

A special marketing section has been set up to ensure that maximum opportunity is taken of the impressive new markets offered as a result of the oil and gas exploration in the North Sea. Welding Products and Gases Divisions are working closely together and as the UK supplier with by far the most comprehensive product range of gas and arc welding and cutting equipment and consumables, available from bases in both the UK and the Continent, BOC is well-placed. Several large orders have already been received.

Autolynx units introduced less than two years ago are now being sold in 28 countries. Negotiations have recently been concluded for the sale of electrode and wire mesh production plants to Yugoslavia valued at over £1 250 000 and we have sold ten large Condor ratio cutting machines to Romania.

On the Continent, Smit Weld has made worthwhile progress in the difficult conditions prevalent in Holland, Belgium and Germany, and has introduced a range of MIG equipment designed and manufactured by BOC to meet the specific demands of the European mainland customer.

Advanced Engineering Division

This Division's remit has a worldwide bias in vacuum engineering, Cryo products and medical and industrial

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Report of the Directors

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equipment is able to report increased sales and profits for the third year in succession.

Edwards High Vacuum substantially increased its market share in spite of difficult trading conditions. BOC's first factory in Japan, built by our joint venture Nissin Edwards Shinku KK, has just been completed. We have acquired a substantial interest in a large Brazilian industrial refrigeration company, MADEF SA and, using this as a base, are introducing the Edwards vacuum and cryogenic products to the Brazilian market. Our Italian vacuum company has also had a successful year and the factory built in Milan last year is now fully occupied.

Our medical and aviation activities also made excellent progress. The product range was much widened and now includes electronic products whilst our traditional equipment range was strengthened by the introduction of new models. We foresee further growth in these activities and intend to alter and enlarge our organisation to provide for it.

Additionally we acquired the whole share capital of Cyprane Ltd, manufacturers of anaesthetic vaporizers, and their related companies, Fraser Sweatman (Canada) Ltd and Fraser Sweatman Inc in the USA. We intend to encourage and expand these businesses which are complementary to our own.

In Sparklets, we decided to integrate the marketing operations of the UK, USA and German soda syphon and allied equipment businesses. We also centralised our UK warehousing and took other measures aimed at improving profitability. Initial results look encouraging.

Chemicals Division

At Maydown there was again a marked improvement in the Wulff acetylene plant and, for the first time since the plant was commissioned at the end of 1966, customer requirements were fully satisfied.
This reflects great credit on management and employees especially against the background of the difficult conditions in Ulster.

At Chester-le-Street the additional £1 250 000 tall oil refining plant has been commissioned and is operating satisfactorily. Total capacity of this plant, the only one of its kind in the UK, is nearly 50 000 tons a year.

Our company at Odda in Norway continues to show improved performance. Its profits are unlikely to be much affected by the decision of Norway not to join the EEC.

We are constructing at Gunness Wharf in Lincolnshire a plant to prepare special carbide mixtures for sale to the British Steel Corporation for desulphurization of steel melts. This is expected to be profitable in its own right, and to become a major new outlet for Odda carbide.

Metals Division

The recession in metals markets continued [illegible] the year and demand was further depressed [illegible] consequences of the miners' strike. Markets [illegible] additives, such as ferromolybdenum manufactured [illegible] Division at Rainham and at Widnes, were particularly affected.

The year has seen considerable strategic reconstruction. Murex Hispania and Broomfield Carbide Gauges have been sold. Production Tool Alloys, a hard metal manufacturing business operating from Sharpenhoe in Bedfordshire has been purchased and the analogous activities hitherto carried on at Murex, Rainham have been moved to Sharpenhoe, thus forming a much more effective trading unit in this important market area.
Markets for Deloro Stellite were depressed, but profitability was maintained though difficulties in establishing satisfactory operations from the Koblenz branch have been greater than originally anticipated.
The results of the Division in the current year will depend particularly on any increase in steel production, especially alloy and special steels.

Food Services Division

Food Services Division further developed its policy of concentrating in well-defined growth areas of food processing and distribution. The disposal of the general transport companies was completed and our holding in BOC-Linde was reduced to a minority 25% share with our partners Linde AG taking the lead.
Batchelors, where operating efficiency has greatly improved, made sharply increased profits in better trading conditions. A new soft drink canning line, installed at the beginning of the summer peak sales season, made a notable contribution.
King Harry Foods, set up in 1971 to exploit opportunities in high value frozen foods, began supplying major customers with a range of pizzas. A factory has been built at Thame, Oxfordshire, with the latest equipment and trained staff to produce convenience foods under high standards of hygiene.
J Muirhead, Winchester Frozen Foods and Ace Refrigeration continued to expand in their growing markets and El Fresno established itself in Spain as a vegetable processor and exporter.

BOC Transhield Ltd

BOC Transhield was set up to provide an expert and high quality food distribution service to Marks & Spencer's stores. It operates a series of depots located strategically to cover the whole UK area. The sale of most of its general haulage companies, originally associated with the operation, has been completed and Transhield can now concentrate on providing a tailor-made specialist service.
In its third full year of operation, results have been very satisfactory. We are extending its key depots to meet growing demand.

Overseas Companies

For most Group companies outside Europe, trading conditions tended to be more difficult than in recent times and cost inflation continued. Total overseas trading profits increased by £526 000 to £16 054 000.

AUSTRALIA

In spite of the depressed level of the Australian economy, CIG sales were 5·6% higher than the previous year at $A66 155 000. Due to the low level of activity in the metal fabricating industry, the sales volumes of industrial oxygen and welding electrodes were actually lower than 1971, but this was more than made good by sales of new products. Operating profit was 6% above last year at $A11 401 000.

CIG secured another important contract for the on-site supply of nitrogen and other gases to the Pilkington/ACI float glass project near Melbourne. Its new Westernport plant started to serve the new steelworks there and the company strengthened its position in the newly entered carbon dioxide market.

In 1972, CIG acquired the total shareholding in ISS Holdings Pty Ltd, prominent Australian manufacturers of protective clothing and safety equipment, whose products are now distributed by the Group's widespread marketing organisation in Australia and elsewhere.

CIG's new company in Indonesia, formed in partnership with Indonesian interests, commenced operations during the year: and their company in Thailand made good progress towards becoming a viable operation.

SOUTH AFRICA

Afrox sales continued to be affected by the sluggish state of the engineering sector of the economy and by severe competitive pressure on prices in the main area of operation —industrial gases. Afrox substantially maintained its share of this market, in which it now faces three major competitors, but profits suffered from the combined effect of cost inflation and lower prices.

Dowson & Dobson's sales and profits were both well up on last year and in line with forecasts, a satisfactory performance in the context of the widespread cut back in spending. During the year, the operations of Reid Bros (South Africa) Ltd were integrated into those of other Afrox companies, particularly Dowson & Dobson. Also completed was the concentration of electrode manufacture at the new Brits factory. Both these involved some non-recurring expense, but were part of a major rationalization programme of Afrox Group trading activities which will help the company to benefit from the anticipated growth of the economy in 1973.

Afrox group sales at R75 097 000 were 5% above last year. Operating profit at R7 194 000 was 3% lower.

During the year, a new 100 ton a day liquid oxygen/nitrogen plant, intended to produce low cost product exclusively for the merchant market and as large as any installed in the Southern Hemisphere, was completed at Germiston.

INDIA

In the early part of the year, a number of external factors such as the Indo-Pakistan conflict, rail and coal strikes, and labour unrest affected Indian industrial output with a consequent impact on IOL's sales. But as progressively fewer restrictions affected IOL's business through the year, sales for the year at Rs35 372 000, 15% above last year, and operating profit to Rs8 567 000, an improvement of 7%.

The expansion program of IOL is still not satisfied. Government of India's policy will restrict the company's ability to expand in its traditional areas to meet the constantly growing demand for its products, but new opportunities for development are constantly being sought and we are hopeful that progress will be achieved in 1973. In the meantime, IOL has started to manufacture small oxygen plants for sale to users and competitors in India and has recently received a licence to manufacture acetylene plants as well.

CANADA

After a slow start, trading conditions improved as the year progressed. For Canox, 1972 was a year of consolidating the businesses acquired in the previous two years. Canox's traditional industrial and medical businesses had a good year, but there is still some way to go before the recent acquisitions make their proper contribution. Canox's position in the carbon dioxide market was strengthened during the year by the commissioning of a large plant at Niagara Falls, Ontario, jointly owned with Canadian Liquid Air.

Canox total sales increased by 9% to SC28 049 000 and operating profit improved by 18% to SC2 124 000.

OTHER OVERSEAS COMPANIES

The four major companies in Australia, S. Africa, India and Canada provided 75% of the trading profits earned overseas. Among the smaller companies, New Zealand Industrial Gases (NZIG) maintained its position during another year of severe inflationary pressure, combined with statutory price control. It made a profit of $NZ1 569 000, 4% lower than in 1971. NZIG recently extended its product range by purchase of the carbon dioxide business of Carbonic Ice Limited.

East African Oxygen, with operations in Kenya, Tanzania and Uganda, had another satisfactory year with operating profit of £K399 000 marginally above 1971.

In Zambia, the sale of 51% of Zambia Oxygen to the Industrial Development Corporation was completed, effective from 1st April 1972, BOC retaining management responsibility. Sales and profits in Zambia again showed healthy growth.

Events in the eastern part of Pakistan, which led to the creation of Bangladesh, substantially affected Pakistan Oxygen's results. In common with other companies in Pakistan, Pakistan Oxygen has not declared a dividend for 1972 owing to the need to write off net current assets in the East.

The plants in Bangladesh are in full production again and a new BOC company—Bangladesh Oxygen—is being formed as this report goes to press.

Improved business activity in both Singapore and Hong Kong led to better results than anticipated; in Malaysia some upturn in the economy was offset by increased competition.

Our company in Sri Lanka (formerly Ceylon) operated in a difficult political and economic environment throughout the year. In the circumstances, the results achieved were up to expectations.

In Nigeria demand for our products continued to grow rapidly and local production increased substantially. Good progress was made in the Lagos area. In other parts of the country, the civil war and outstanding accounts are being reduced.

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In Rhodesia, we undertook and our company expanded a most satisfactory growth in activity leading to a further rise in profit. But under present conditions, of course, none of the benefit is available by way of dividend to BOC.

Electric Arc (Jamaica) Ltd started production of welding electrodes in April.

New Venture Secretariat

The organisation of our research and development effort in the UK through the New Venture Secretariat set up in 1971 developed well.

Cryogenic Refrigeration Systems licensed the use of its highly reliable helium gas bearing expansion turbines to Cryogenic Technology Inc, for use in the USA and in other countries, and successfully commissioned the refrigerator for the superconducting motor-generator system being built by IRD (International Research & Development Co Ltd) for the Ministry of Defence.

We are also training divers in the improved techniques in underwater welding which we have developed with the support of the Department of Trade and Industry. The techniques are being incorporated into a service being offered for underwater work in the North Sea and elsewhere.

In collaboration with the Welding Institute, one of our ventures—Industrial Laser Systems—is producing a 2-kilowatt laser believed to be the highest powered commercially available in Europe. It will be used in laser cutting equipment and for development of laser welding processes.

In an allied field we have sold our first electron beam gun system on the Continent where it will be used in a special sterilising operation in connexion with food packaging.

Computer Centre

To contain operating costs and prepare for the future, all our major computer hardware resources in the UK have been linked together through a powerful new facility, the BOC Computer Centre which has been established in London. This makes computer power available over telephone lines to our factories and offices throughout the UK. While the computer technology has been centralised, responsibility for making effective use of it rests with the profit responsible management in the trading divisions.

We have already begun to improve our use of invested capital at local level through computer-based systems of transport scheduling, production planning and stock control.

We are capitalising our expertise by marketing the services of the BOC Computer Centre to business at large. Our customer list includes well-known companies, statutory authorities and consultants in the UK. We expect this activity to become increasingly profitable.

Management development

In May we had the formal opening of the extension to our long-established training centre at Chartridge Lodge near Chesham. This development has not only doubled the number of bedrooms available but also provided two new lecture rooms, with much improved facilities for special conferences, seminars, meetings etc. These extended facilities have enabled us to press forward with the development of new training courses reaching a wider number of BOC employees both from the UK and overseas.

Pensions

We believe the Company has a continuing commitment to our retired employees, and we have made it possible for the Pension Trustees to grant the [illegible] and valuations as at first charge on [illegible] pensions, deferred pensions, widows' and [illegible] benefits. As a result such pensions have [illegible] compound rate of 4½% per annum over the [illegible] years.

We are also conscious of the need to provide [illegible] pensions and death benefits for our existing employees on a scale comparable with the best provided in industry. In some respects our present schemes fall short of this; we intend, therefore, to amend our schemes in a way which anticipates the Government's legislation in the field of occupational pensions.

Provision for retirement or death in service is a matter which should be considered by every employee, whatever his age, and we are taking steps to ensure that each has enough information upon which to make a value judgement for his individual circumstances.

This process of discussion and communication is now being reinforced by a team of Pension Counsellors to serve existing employees and a team of Pensioner Visitors for pensioners; we like to use existing pensioners for the latter and would always be glad to know of any volunteers for this rewarding service.

Directors' interests

The Register kept by the Company for the purpose of Section 27 of the Companies Act 1967 shows that the number of Ordinary shares of the Company in which the Directors of the Company and their families had an interest as at 1st October 1971 and 30th September 1972 were as follows:

ORDINARY SHAREHOLDINGS	30/9/72	1/10/71 (or at date of appointment)
Beneficial		
Mr L E Smith	1 000	1 000
	*55 000	*55 000
Sir Geoffrey Eley	15 595	15 595
Sir John Cowley	3 200	3 200
Lord Elworthy	2 000	2 000
Mr I J Fraser	5 000	—
Sir Owen Wansbrough-Jones	5 280	[illegible]
Mr P Laister	1 000	[illegible]
	*45 000	[illegible]
Mr J M Williams	2 000	[illegible]
	*45 000	[illegible]
Mr R C Hesketh-Jones	4 042	[illegible]
	*45 000	[illegible]
As trustee		
Sir Geoffrey Eley	26 464	[illegible]
Mr R C Hesketh-Jones	2 009	

Notes

1. All ordinary shares are fully paid unless marked with an * which are 5% paid.
2. No Director has a beneficial interest in any debentures or preference shares of the Company or in any shares or debentures of any subsidiary company.
3. There have been no changes in the Directors' interests between 30th September 1972 and 11th January 1973.

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Report of the Directors continued

Directors and auditors
The Directors are named on page 6. The Director retiring by rotation is Sir John Cowley GC KBE CB who is willing to be reappointed.

Mr I J Fraser CBE MC was appointed to the Board on 1st April 1972. He retires at the Annual General Meeting in accordance with Article 95 and, being eligible, offers himself for re-election.

The Auditors, Cooper Brothers & Co, have informed the Company of their intention to change the name in which they practise to Coopers & Lybrand with effect from 1st April 1973. They will continue in office in accordance with the provisions of Section 159(2) of the Companies Act 1948.

Share and loan capital
During the year the following new issues were made:

940 444	Ordinary shares of 25p each as a result of conversion of £508 348 7½% Convertible Unsecured Loan Stock 1987/92 by stockholders in accordance with the terms and conditions of the Trust Deed constituting the stock.
854 766	Ordinary shares of 25p each as part consideration for the acquisition of Production Tool Alloy Limited.
579 710	Ordinary shares of 25p each as consideration for the acquisition of the outstanding 69 279 'B' shares in Hirst Welding Rectifiers Limited.

The above issues account for the increase of £918 000 in the share premium.

Interests in Company's share capital
So far as can be ascertained no one person or corporation holds or is beneficially interested in any substantial part of the share capital of the Company.

Charitable and political contributions
During the year ended 30th September 1972 Group companies in the United Kingdom made charitable and educational payments totalling £24 000.
In accordance with long established practice no political contributions were made by the group in the UK.

Exports
The value of goods exported by the Group from the United Kingdom was as follows:

	£'000
to BOC companies	4 992
to others	11 863
	16 855

Profits earned from overseas investments, after allowing for local taxation and the interests of minority shareholders, totalled £5 782 000 for the year.

Employees in the UK

Average number employed	19 960
Aggregate remuneration	£36 397 000

By order of the Board
C A B Leslie
Secretary

London
2nd February 1973

Report of the Auditors

To the Members of
The British Oxygen Company Limited

In our opinion, based on our examination and the reports of the auditors of certain subsidiary and associated companies not audited by us and on the unaudited management accounts of some associated companies, the accounts set out on pages 15 to 27 [illegible] give a true and fair view of the state of affairs at 30th September 1972 and of the profit for the year ended on that date and comply with the Companies Acts 1967 and 1968.

Cooper Brothers & Co
Chartered Accountants

London
2nd February 1973

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Accounting principles

1 Fixed assets

(a) United Kingdom investment grants are deducted from the cost of the assets.

(b) Depreciation is calculated to write off the assets (other than certain tonnage plants) during their expected normal lives by equal annual instalments (the straight line method) at rates ranging from 2½% to 25% per annum depending upon the type of asset. Depreciation on tonnage plants commissioned in the United Kingdom since 1st October 1969 is calculated on an annuity basis.

(c) Specific provision is not made for the replacement of fixed assets but, in the opinion of the directors, depreciation, profits retained and borrowing facilities available are adequate for this purpose.

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2 Stock and work-in-progress

Stock and work-in-progress is valued at cost or net realisable value whichever is lower, and cost where appropriate includes a proportion of overhead expenses. Profits are not taken on construction contracts until completion but provisions are made for all known or anticipated losses.

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3 Debtors

Known bad debts are written off and specific provision is made for any considered to be doubtful of collection. In addition, general provisions of 1% to 2½% are made on the balance of trade debts.

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4 Deferred taxation

This represents tax at current rates on the excess of accumulated taxation capital allowances over depreciation provisions charged, this excess being reduced by expenditure not deductible for tax purposes until later years.

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5 Development and research expenditure

Group expenditure (which comprises the costs of operating the development and research centres, United Kingdom and overseas, inclusive of appropriate overheads) is written off when incurred.

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6 Trading profit

It is policy to arrive at trading profit [illegible] normal trading conditions and to [illegible]

(a) extraordinary profits and losses arising [illegible] the year,

(b) capital profits and losses.

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7 Associated companies

The Group share of profits less losses in associated companies is consolidated where the Group interest is between 20%–50% and the investment is for the long term and material.

Where audited accounts are not co-terminous with those of the Group, the share of profits less losses has been arrived at from the last audited accounts available and unaudited management accounts to 30th September.

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8 Investment income

Income from investments, other than those consolidated as associated companies under note 7 above, is included in trading profit only if received, or declared and receivable.

---

9 Exchange rates

All currency figures are converted at the rates of exchange ruling at the financial year end.

---

10 Sales

Sales are based on invoiced value excluding inter-company sales.

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Consolidated profit and loss account

		1972	1971
		£'000	£'000
	Sales	252 589	234 342
1, page 18	**Group trading profit, including associated companies**		
	United Kingdom and Europe	17 476	14 921
	Overseas	16 054	15 528
		33 530	30 449
	Less development and research	2 631	2 424
		30 899	28 025
3, page 18	*Less* interest paid	8 440	7 894
	Group profit before tax	22 459	20 131
4, page 18	*Less* taxation	9 864	8 688
		12 595	11 443
	Less attributable to minority shareholders	2 240	2 350
	Group profit attributable to parent company	10 355	9 093
7, page 19	*Less* extraordinary items (net), after tax	110	368
		10 245	8 725
	Add transitional and non-recurring credit for notional Advance Corporation Tax	902	—
8, page 19	**Disposable profit**	11 147	8 725
	Dividends:		
	Preference	122	122
	Ordinary: interim 1p (1971: 1p)	2 035	2 031
	proposed final 2p (1971: 2p)	4 070	4 062
		6 227	6 215
	Retained profit	4 920	2 510
		11 147	8 725

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PARENT 1972 £'000	PARENT [illegible] £'000		NOTES	1972 £'000	[illegible] £'000
67 142	[illegible]	Fixed assets	10, page 20 11, page 21	141 523	[illegible]
62 302	70 380	Subsidiary companies	12, page 21	—	—
1 319	1 214	Associated companies and investments	13, page 21	6 523	[illegible]
50 641	41 086	Current assets	14, page 22	141 301	155 803
181 904	177 611			299 844	273 817
41 527	37 766	*Less* current liabilities and provisions	15, page 22	94 362	80 895
140 377	139 845			205 482	192 922
		Financed by:			
50 879	50 282	Issued ordinary shares of BOC	19, page 24	50 879	50 282
8 188	7 270	Share premium		8 188	7 270
14 587	12 317	Reserves	20, page 24	35 084	32 255
73 654	69 869	Ordinary shareholders' interests		94 151	89 807
2 500	2 500	Issued preference stock of BOC	19, page 24	2 500	2 500
—	—	Minority shareholders' interests		20 771	20 083
76 154	72 369			117 422	112 390
38 675	38 977	Long term loans	16, page 23	53 058	51 676
17 259	21 653	Short term loans	17, page 23	22 264	24 420
8 289	6 846	Deferred taxation		12 738	10 436
140 377	139 845			205 482	198 922

Signed on behalf of the Board:

L E Smith *Director*

Geoffrey Eley *Director*

18 Notes on accounts

CONSOLIDATED PROFIT AND LOSS ACCOUNT

	1972	1971
	£'000	£'000
1 Group trading profit, including associated companies, is after charging:		
Depreciation—United Kingdom and Europe	9 361	9 211
Overseas	5 853	5 425
	15 214	14 636
Pension and provident funds contributions	3 320	2 530
Audit fees (parent company £56 000)	289	247
Emoluments of directors of parent company		
As directors	8	8
For management *note 5, page 19*	144	132
Payments to past directors and dependants of past directors of parent company	24	22
and after crediting:		
Share of profits of associated companies	799	504
Other investment income received and receivable	25	443
2 Investment income		
Total investment income (including that from associated companies) dealt with in the accounts in accordance with schedule 2 para 12(g) of the Companies Act 1967—all unquoted	317	620
3 Interest paid		
Bank loans, overdrafts and other loans repayable within five years	4 273	4 052
All other loans	4 167	3 842
	8 440	7 894
4 Taxation on profit of year		
United Kingdom—corporation tax at 40% (1971: 40%)	2 641	2 207
deferred taxation	2 428	1 486
	5 069	3 693
Reduced by—double tax relief	1 914	[illegible]
overspill relief	59	—
	3 155	[illegible]
Overseas—taxes	6 195	
deferred taxation	852	
related [illegible]	321	[illegible]
	10 523	
[illegible] for prior years no longer required	3[illegible]	
	[illegible]	

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	1972 £'000	
5 Directors' emoluments		
Two directors served as Chairman during the year and their emoluments whilst serving in that capacity were as follows:		
Mr J S Hutchison	6	15
Mr L E Smith	15	—
As highest paid director, Mr L E Smith's emoluments for the full year were £26 000 (1971: £24 000)		
	Number	Number
Up to £2 500	5	5
£5 001 to £7 500	1	—
£7 501 to £10 000	—	1
£10 001 to £12 500	1	—
£15 001 to £17 500	—	1
£17 501 to £20 000	3	3
£22 501 to £25 000	—	1
£25 001 to £27 500	1	—

6 Senior employees' emoluments

	Number	Number
£10 001 to £12 500	7	6
£12 501 to £15 000	1	2
£15 001 to £17 500	2	—

7 Extraordinary items (net), after tax

		£'000
Rationalisation and divestment costs		1 135
Less Profit on sale of properties	921	
Other items (net)	104	
		1 025
		110

8 Dividends from overseas subsidiary and associated companies

The unappropriated profits of overseas subsidiary and associated companies are liable to overseas taxes and United Kingdom taxation, subject to double tax relief, if distributed as dividends. There are exchange control restrictions in certain overseas countries on the remittance of funds to the United Kingdom.

9 Earnings per share

	1972 £'000	1971 £'000
Group profit attributable to parent company	10 355	9 [illegible]
Less Preference dividend	122	122
Earned for 25p ordinary shares	10 233	8 971
Earnings in pence per share	5·03p	4·40p

Earnings per share have been calculated on the number of 25p ordinary shares ranking for dividend at 30th September 1972 – 203 470 477 (1971: 204 085 [illegible]).

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20 Notes on accounts

BALANCE SHEET DETAILS

10 Fixed assets

GROUP	TOTAL	FREEHOLD AND LEASEHOLD PROPERTIES	PLANT AND MACHINERY	CYLINDERS	MOTOR VEHICLES	FURNITURE AND FIXTURES
	£'000	£'000	£'000	£'000	£'000	£'000
Cost or valuation 1/10/71	262 280	47 373	140 683	52 789	15 201	6 234
Exchange adjustment	412	99	293	154	(53)	(81)
New subsidiaries	5 782	3 396	1 738	105	242	301
Capital expenditure	24 254	4 351	10 659	5 023	3 557	664
Demolitions and sales	(11 675)	(2 050)	(5 001)	(1 882)	(2 371)	(371)
Cost or valuation 30/9/72	281 053	53 169	148 372	56 189	16 376	6 747
Depreciation 1/10/71	119 988	12 311	70 046	27 123	6 516	3 992
Exchange adjustment	(122)	(28)	17	(15)	(32)	(64)
New subsidiaries	1 369	270	850	23	118	108
Provided during year	15 214	1 288	8 392	3 185	1 833	516
Demolitions and sales	(6 916)	(539)	(3 311)	(1 186)	(1 615)	(265)
Depreciation 30/9/72	129 533	13 302	75 994	29 130	6 820	4 287
Net book value 30/9/72	151 520	39 867	72 378	27 059	9 756	2 460
PARENT						
Cost 1/10/71	123 677	14 418	76 915	21 892	7 879	2 573
Capital expenditure	9 023	2 143	2 860	1 843	1 882	295
Transfer from group companies	2 833	443	2 132	—	54	204
Demolitions and sales	(5 493)	(840)	(2 827)	(859)	(813)	(124)
Cost 30/9/72	130 040	16 164	79 080	22 876	8 972	2 948
Depreciation 1/10/71	58 755	4 965	37 920	10 873	3 208	1 789
Provided during year	6 303	465	3 683	1 237	725	193
Transfers from group companies	1 667	56	1 459	—	29	123
Demolitions and sales	(3 827)	(303)	(2 676)	(705)	(508)	(120)
Depreciation 30/9/72	62 898	5 183	40 976	11 405	3 454	1 979
Net book value 30/9/72	67 142	10 981	38 104	11 471	5 518	969

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10 Fixed assets *(continued)*

	PARENT	GROUP
	£'000	£'000
The net book value of leasehold properties at 30th September 1972 included above is:		
Long term	3 170	6 278
Short term	1 058	1 937
	4 228	8 215

11 Asset revaluations

Seven overseas companies revalued certain fixed assets in the years 1966, 1967 and 1970 which increased their then book values by £2·3 million approximately.

12 Subsidiary companies

	1972 £'000	*1971 £'000*
Shares at cost and scrip issues at par, less amounts written off	22 539	*16 679*
Amounts owing to parent, including dividends since declared	46 769	*57 765*
	69 308	*74 444*
Less amounts owing by parent, less dividends since declared	7 006	*4 055*
	62 302	*70 389*

13 Associated companies and other investments

	PARENT		GROUP	
	1972 £'000	*1971 £'000*	1972 £'000	*1971 £'000*
ASSOCIATED COMPANIES CONSOLIDATED				
Shares at cost	75	*75*	812	*596*
Group share of post acquisition earnings, less goodwill on acquisition	—	—	1 284	*696*
	75	*75*	2 096	*1 292*
OTHER INVESTMENTS (including associated companies not consolidated)				
Equity interests at cost less amounts written off	290	*691*	1 641	*1 492*
Non equity interests	—	—	117	*89*
TOTAL EQUITY AND OTHER INTERESTS *see analysis overleaf*	365	*676*	3 854	*2 873*
AMOUNTS OWING TO PARENT OR GROUP (NET)	1 454	*538*	2 669	*793*
	1 819	*1 214*	6 523	*3 666*

continued

13 Associated companies and other investments (continued)	PARENT		GROUP	
The total equity and other interests are analysed between quoted and unquoted investments as follows:	1972 £'000	*1971 £'000*	1972 £'000	*1971 £'000*
Quoted				
UK stock exchanges	236	—	236	—
other stock exchanges	—	—	9	*7*
	236	—	245	*7*
the market value of which is	*238*	—	*245*	*6*
Unquoted				
equity at directors' valuation	129	*676*	3 492	*2 777*
others at directors' valuation	—	—	117	*80*
	365	*676*	3 854	*2 864*

14 Current assets				
Stock and work in progress	20 967	*14 619*	64 651	*63 021*
Debtors and payments in advance	26 423	*23 985*	68 254	*62 950*
Investment and Regional Development Grants receivable	1 669	*2 319*	2 136	*2 956*
Tax reserve certificates	—	—	12	*64*
Deposits at short call	—	—	1 729	*774*
Cash and bank balances	1 582	*163*	4 969	*4 121*
	50 641	*41 086*	141 801	*133 666*

15 Current liabilities and provisions				
Creditors and accrued liabilities	18 465	*16 932*	47 277	*44 794*
Bank overdrafts	3 545	*7 867*	17 342	*14 584*
Other loans repayable within one year	12 915	*7 705*	14 300	*8 313*
Taxation—United Kingdom	441	*1 214*	2 279	*2 [illegible]*
Overseas	56	*22*	7 059	*[illegible]*
Ordinary dividends—interim	2 935		2 935	
proposed final	4 073	*[illegible]*	4 073	*[illegible]*
	41 527	*[illegible]*	[illegible]	*[illegible]*

[illegible]

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16 Loans—long term

	PARENT			
	1972	1971	1972	
	£'000	£'000	£'000	
5¾% Debenture stock 1981/86: secured	7 395	8 [illegible]	7 395	8 [illegible]
6¾% Debenture stock 1985/90: secured	6 230	6 [illegible]	6 230	[illegible]
8½% Tonnage Debenture stock 1988: secured	6 000	*6 000*	6 000	*6 000*
8½% Tonnage Debenture stock 1990: secured	7 500	*7 500*	7 500	*7 500*
11% Tonnage Debenture stock 1992: secured	10 000	*10 000*	10 000	*10 000*
7½% Unsecured loan stock 1987/92	200	*709*	200	*709*
6% Loan 1978/80: unsecured	—	—	1 016	*950*
7% Debenture stock 1981: secured	—	—	121	*115*
7% Debenture stock 1986: secured	—	—	185	*175*
7¼% Debenture stock 1983: secured	—	—	1 039	*981*
7½% Debenture stock 1981: secured	—	—	3 530	*3 330*
7½% Mortgage loan 1986: secured	—	—	462	*416*
7¾% Debenture stock 1979: secured	—	—	850	*803*
7¾% Debenture stock 1984: secured	—	—	211	*199*
8¾% Debenture stock 1981/95: unsecured	—	—	4 103	*4 512*
10½% Mortgage Loan 1979: secured	—	—	180	—
Other debenture and mortgage loans —secured £1 384 000 *(1971: £1 038 000)*. These other debenture and mortgage loans are repayable over the years 1973 to 1998 and carry interest rates varying between 2¾% and 10%	—	—	1 601	*1 038*
	37 325	*38 977*	50 623	*51 525*
Bank borrowings repayable in 1977/78	1 350	—	2 435	*151*
	38 675	*38 977*	53 058	*51 676*

The parent company bank borrowings above were unsecured. Of the group bank borrowings, £380 000 was secured *(1971: £151 000)*.

17 Loans—short term

Repayable during year to: 30th September 1974	—	*8 092*	816	*9 021*
30th September 1975	4 453	*302*	5 652	*993*
30th September 1976	7 535	*2 540*	9 185	*2 997*
30th September 1977	5 271	*10 719*	6 613	*11 409*
	17 259	*21 653*	22 264	*24 420*

The parent company short term loans were unsecured. Of the group short term loans, £2 822 000 were secured *(1971: £2 569 000)*.

18 Bank loans and overdrafts

The total of bank borrowings is as follows:

Included within loans repayable within one year	*note 15*	12 835	*7 764*	13 344	[illegible]
Included within long term loans	*note 16*	1 350	—	2 435	*151*
Included within short term loans	*note 17*	17 259	*21 653*	20 [illegible]	[illegible]
Bank overdrafts	*note 15*	3 545	*7 907*	17 342	[illegible]
		34 989	*37 324*	53 421	[illegible]

The parent company bank borrowings above were unsecured. Of the group bank borrowings, £3 264 000 was secured *(1971: £2 [illegible])*.

24 Notes on accounts

19 Share capital	AUTHORISED	ISSUED	
	1972	1972	1971
	£'000	£'000	£'000
Ordinary shares of 25p (fully paid)	50 868	50 868	50 271
Ordinary shares of 25p (5% paid)	223	11	11
Shares of 25p	6 409	—	—
	57 500	50 879	50 282
6½% Cumulative preference stock	500	500	500
5% Cumulative second preference stock	1 000	1 000	1 000
4% Cumulative second preference stock	1 000	1 000	1 000
	2 500	2 500	2 500

20 Movements in reserves during year

	PARENT	GROUP
	£'000	£'000
Capital		
Balance at 1st October 1971	3 032	6 485
Retained (part of £4 920 000)	265	605
Scrip issue by subsidiary	—	111
Surplus arising on liquidation of subsidiary	590	—
Others	28	(40)
	3 915	7 161
Less goodwill on acquisition of subsidiaries	—	1 932
disposal of controlling interest in subsidiary	—	387
exchange losses	—	56
	3 915	4 786
Revenue		
Balance at 1st October 1971	9 285	25 075
Retained (part of £4 920 000)	1 387	4 128
Exchange profits	—	4
	10 672	29 207
Less scrip issue by subsidiary	—	111
disposal of controlling interest in subsidiary	—	73
others	—	9
	10 672	29 014
Associated companies		
Balance at 1st October 1971	—	695
Retained (part of £4 920 000)	—	137
Exchange profits	—	47
Minority interest in former subsidiary	—	355
	—	1 234
Total reserves	14 587	[illegible]

EX-11-2

21 Capital commitments

	PARENT	GROUP
	£'000	£'000
Projects for expenditure on capital account at 30th September 1972:		
Against which orders had been placed	957	6 660
Authorised by the Directors but not committed	4 067	8 540
	5 024	15 200

22 Contingent liabilities

The parent company has contingent liabilities amounting to £4 819 000 in respect of bank and other guarantees, the majority on behalf of subsidiary and associated companies. Subsidiary companies have contingent liabilities of £1 172 000 in respect of guarantees to third parties.

23 Pension fund contributions

Two overseas subsidiary companies are under obligation to contribute to the Trustees of their Pension Funds £128 000 per annum over periods varying from three to sixteen years.

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Principal subsidiary and associated companies

The following lists include subsidiary and associated companies carrying on business, the results of which, in the opinion of the Directors, principally affected the amount of the profit or the amount of the assets of the Group. Associated and subsidiary companies of BOC not listed below will, where appropriate, be shown in the forthcoming annual return.

Unless otherwise stated companies are held through The British Oxygen Company Limited or BOC Holdings Limited, a wholly-owned subsidiary of The British Oxygen Company Limited and the shares held are ordinary shares.

BOC Holdings Limited is a company formed for the convenient holding of shares in certain subsidiary and associated companies.

In the case of those companies where percentage equity is 50% or less, the attributable profits or losses have been consolidated into trading profit in accordance with the Institute of Chartered Accountants Statement on Associated Companies. This does not include associated companies which do not materially contribute to Group profits.

The UK and European companies operate as part of the trading divisions under whose names they are shown. In some cases they represent only a small proportion of the business carried on by those divisions, which trade as part of The British Oxygen Company Limited.

IN UK AND EUROPE

	%
ADVANCED ENGINEERING	
Associated British Hospital Equipment Ltd	100
Cyprane Ltd	100
Edwards Alto Vuoto SpA (Italy)	100
Saccab SpA (Italy)	100
CHEMICALS	
British Oxygen Chemicals Ltd	100
British Oxygen Maydown Ltd	100
British Solvent Oils Ltd	100
Odda Smelteverk A/S (Norway)	100
FOOD DISTRIBUTION	
BOC Transhield Ltd	100
FOOD SERVICES	
Ace Refrigeration Ltd	100
Batchelors Ltd (Eire) (a)	100
BOC-Linde Refrigeration Ltd	25
El Fresno SA (Spain)	50
J Muirhead Ltd	100
Winchester Frozen Foods Ltd (b)	100
GASES	
BOC Northern Ireland Ltd (N Ireland) (b)	75
Irish Industrial Gases Ltd (Eire)	75
A/S Kulsyre & Tørrisforlaget 'Orion' (Denmark) (b)	100
Nordisk Kulsyre Skrid A/S (Denmark) (b)	94
Scafrane Company Ltd (a)	51
[illegible]	100
[illegible]	100
[illegible]	100
[illegible]	100
[illegible]	50

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IN UK AND EUROPE

	%
PLANT	
Cryoplants Ltd	100
WELDING PRODUCTS	
British Industrial Gases Ltd	100
Hirst Welding Rectifiers Ltd (c)	100
Sirit Weld BV (Netherlands)	54
HEAD OFFICE	
BOC Deutschland GmbH (Germany)	100
BOC Holdings Ltd	100
Hirst Electronic (Holdings) Ltd	100
Mealstream (UK) Ltd	75

OUTSIDE EUROPE

AUSTRALIA	The Commonwealth Industrial Gases Ltd	59
BRAZIL	Madef SA (b)	23
CANADA	Canadian Helium Ltd	33
	Canadian Oxygen Ltd	100
	Edwards High Vacuum (Canada) Ltd	100
	Frazer Sweatman (Canada) Ltd	100
HONG KONG	Hong Kong Oxygen & Acetylene Co Ltd (b)	50
INDIA	Indian Oxygen Ltd	66
JAMAICA	Electric Arc (Jamaica) Ltd	76
JAPAN	Nissan Edwards Shinku K K	50
KENYA	East African Oxygen Ltd	89
MALAYSIA	Malayan Oxygen Sdn Berhad	100
NEW ZEALAND	New Zealand Industrial Gases Ltd	63
NIGERIA	Industrial Gases Ltd	50
PAKISTAN	Pakistan Oxygen Ltd	60
RHODESIA	Rhodesia Oxygen (Pvt) Ltd	100
SINGAPORE	Singapore Oxygen Pte Ltd	100
SOUTH AFRICA	African Oxygen Ltd	67
SRI LANKA	Ceylon Oxygen Ltd	100
TANZANIA	Tanzania Oxygen Ltd (b)	100
UGANDA	Uganda Oxygen Ltd (b)	100
USA	Edwards High Vacuum Inc	100
	Fraser Sweatman Inc	100
	Harris Calorific Inc	24
	Leland Industries Inc	100
ZAMBIA	Zambia Oxygen Ltd	49

(a) Includes Preference shares.
(b) Held through a subsidiary other than BOC Holdings Ltd.
(c) The business formerly carried on by Hirst Welding Rectifiers Ltd until 30th September 1972 is now carried on by The British Oxygen Company Ltd, trading under the name of Hirst Welding Rectifiers.

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28 Group directors outside the UK

Australia	THE COMMONWEALTH INDUSTRIAL GASES LTD	
	K O Humphreys CHAIRMAN R R Law-Smith DEPUTY CHAIRMAN J A Davidson MANAGING DIRECTOR	DIRECTORS R McR Grimlinton A S Grimwade Sir Richard Randall L E Smith W R D Stevenson A W Stewart
Brazil	MADEF SA	DIRECTORS A A Körting W J Kuckartz A A Tabbush
Canada	CANADIAN OXYGEN LTD	
	H M Turner CHAIRMAN J A Perham PRESIDENT	DIRECTORS J P Carrière Dr G J Côté A R Dow R C Hesketh-Jones W K Macleod L E Smith M Tanenbaum
Denmark	A/S KULSYRE AND TØRISFABRIKEN 'UNION'	
	P Laister CHAIRMAN	DIRECTORS R Bowdery H J Clausen P Federspiel G Thomsen
	NORDISK KULSYREFABRIK A/S	
	P Laister CHAIRMAN	DIRECTORS R Bowdery A W Nielsen P J Svanholm G Thomsen
Eire	BATCHELORS LTD	
	D W E Stafferton CHAIRMAN P J Loughrey MANAGING DIRECTOR	DIRECTORS M J Byrne J D Dickie D D Frame J Greene P W Harris P Laister W H Magill
	IRISH INDUSTRIAL GASES LTD	
	D D Frame CHAIRMAN M J Garms MANAGING DIRECTOR	DIRECTORS S Warnock Aitken GENERAL MANAGER Samuel W Aitken C A Burden S W Jack D W N Pitts J M Williams
Hong Kong	HONG KONG OXYGEN AND ACETYLENE COMPANY LTD	
	Sir Douglas Clague CHAIRMAN P Saint-Loup VICE CHAIRMAN R Beynon MANAGING DIRECTOR	DIRECTORS W H Henderson R B Josse G M Macwhinnie
India	INDIAN OXYGEN LTD	
	A K Sen CHAIRMAN K Hartley MANAGING DIRECTOR	DIRECTORS P C Basu S Chakravarty H Ghosh K Gopalakrishna R C Hesketh-Jones D C Kothari A K Mukerji L E Smith M A Sreenivasan
Japan	NIPPON EDWARDS SHINKU KK	
		DIRECTORS N Ishizawa H Nakagawa T H C Rufus A I A Ray M W Thatcher
Kenya	EAST AFRICAN OXYGEN LTD	
	[illegible] CHAIRMAN [illegible] MANAGING DIRECTOR [illegible]	DIRECTORS [illegible] C H M [illegible] D A [illegible]

Continued

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Group directors outside the UK

Malaysia	MALAYAN OXYGEN SDN BERHAD C J Boyles CHAIRMAN AND MANAGING DIRECTOR	DIRECTORS D Arnott D F Barrington-Baker D O bin Talib P G Grundy R C Hesketh-Jones K D Moore D Nai-Wai Lee
Netherlands	SMIT WELD BV P Laister CHAIRMAN C F de Gooyer VICE CHAIRMAN	DIRECTORS P H Groeneveld J A Hermans D Melvin N F J Reckitt
New Zealand	NEW ZEALAND INDUSTRIAL GASES LTD T G Hull CHAIRMAN R McR Grinlinton MANAGING DIRECTOR	DIRECTORS W F Airey W G Anderson D G E Brown J A Davidson R C Macdonald L E Smith
Nigeria	INDUSTRIAL GASES LTD	DIRECTORS A W Cobb B W den Hartog K D Moore P J Kleiweg de Zwaan
Norway	ODDA SMELTEVERK A/S P P Stabell CHAIRMAN O S Kristensen MANAGING DIRECTOR	DIRECTORS A Bratt P Laister A Rokne D R Scarffe
Pakistan	PAKISTAN OXYGEN LTD H I Rahimtoola CHAIRMAN M Nasim Khan MANAGING DIRECTOR	DIRECTORS J F C Gallaher R C Hesketh-Jones Khan F M Khan M A Raza J D LeVaillant
Rhodesia	RHODESIA OXYGEN (PVT) LTD G C V Coppen CHAIRMAN P B Thorne DIRECTOR/GENERAL MANAGER	DIRECTORS D H Cummings J B Sutherland C H Targett C J Voss W R Whaley
Singapore	SINGAPORE OXYGEN PTE LTD C J Boyles CHAIRMAN AND MANAGING DIRECTOR	DIRECTORS D Arnott D F Barrington Baker D O bin Talib P G Grundy R C Hesketh-Jones K D Moore D Nai-Wai Lee
South Africa	AFRICAN OXYGEN LTD I Mackenzie CHAIRMAN J B Sutherland GROUP MANAGING DIRECTOR	DIRECTORS C L F Borckenhagen W L Campbell-Pitt A J du Toit I S Haggie I G Halliday W P Rousseau L E Smith A J J Wessels
Sri Lanka	CEYLON OXYGEN LTD D E Martensz CHAIRMAN	DIRECTORS S Cumarasamy R C Hesketh-Jones S K D Jayemanne
Zambia	ZAMBIA OXYGEN LTD A D Zulu CHAIRMAN D J Woodworth MANAGING DIRECTOR	DIRECTORS A W Cobb E A Kashita K D Moore D C Mulaisho V S Musakanya

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30 Comparison of results 1968-1972

THE BRITISH OXYGEN COMPANY LIMITED AND SUBSIDIARY COMPANIES

	1968 £'000	1969 £'000	1970 £'000	1971 £'000	1972 £'000
Group sales and profits					
Sales	134 363	161 251	207 858	234 582	252 539
Group trading profit, including associated companies	20 226	22 345	26 903	30 449	33 530
Less development and research	2 395	2 639	2 589	2 424	2 631
Group profit before interest and tax	17 831	19 [illegible]	24 316	28 025	30 899
Less interest	3 944	4 236	5 431	7 894	8 440
Group profit before tax	13 887	15 470	18 885	20 131	22 459
Group profit after tax attributable to ordinary shareholders	5 947	6 266	8 326	8 971	10 233
Extraordinary profits/(*losses*) after tax	(*17*)	547	(*316*)	(*368*)	(*110*)
Capital employed					
Ordinary shareholders' capital and reserves	78 394	82 985	90 136	89 807	94 151
Deferred taxation	7 157	8 466	8 391	10 436	12 738
Preference stockholders' capital	2 500	2 500	2 500	2 500	2 500
Interests of minority shareholders	13 580	16 503	18 729	20 083	20 771
Short and long term loans	41 562	48 595	52 411	76 096	75 322
Capital employed per balance sheet	143 193	159 049	172 167	198 922	203 482
Add Bank overdrafts and loans repayable within one year	11 187	23 200	29 497	22 927	31 642
	154 380	182 249	201 664	221 849	237 124
Return on average capital employed (based on profit before interest and tax)	12·2%	11·7%	12·7%	13·2%	13·5%
Earnings per fully paid ordinary share (excluding exceptional items and adjusted for rights issue)	3·48p	3·30p	4·17p	4·46p	5·03p
Ordinary dividend per 25p share	2·60p	2·75p	3·00p	3·00p	3·00p
Adjusted for rights issue	2·55p	2·75p	3·00p	3·00p	3·00p
	£'000	£'000	£'000	£'000	£'000
Issued ordinary share capital	42 771	47 [illegible]	49 929	50 002	50 [illegible]
Number of employees					
United Kingdom	16 500	18 [illegible]	19 500	19 [illegible]	[illegible]
Overseas	15 100	18 500	20 [illegible]	23 [illegible]	[illegible]

A 3743

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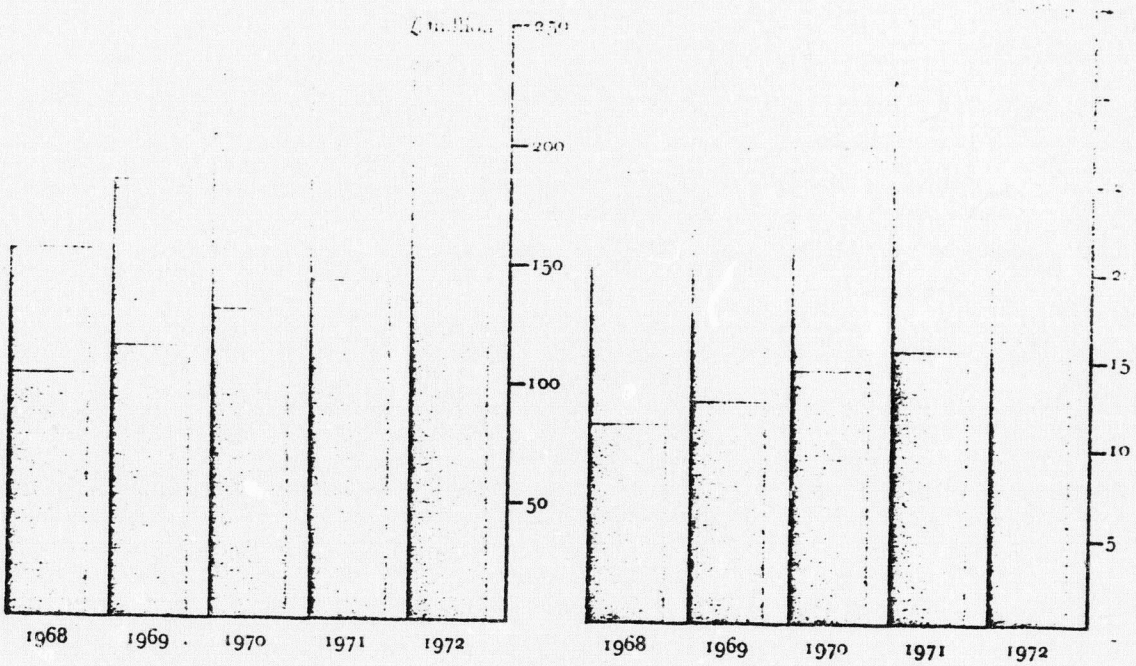

GROUP ASSETS

Net Current Assets
Fixed Assets

GROUP TRADING PROFITS
including associated companies and before development and research, interest and taxation

UK/Europe
Overseas (Outside Europe)

SOURCES AND APPLICATION OF FUNDS

	1968	1969	1970	1971	1972
SOURCES OF FUNDS	£'000	£'000	£'000	£'000	£'000
Retained profit (including minority interests)	2 180	2 216	3 005	3 545	5 866
Depreciation	10 589	11 696	14 034	14 636	15 214
Deferred tax	1 011	1 309	*(75)*	2 045	2 302
Internal cash flow	13 780	15 221	16 964	20 226	23 382
Loan capital	6 791	7 033	3 816	23 685	*(774)*
Bank overdrafts and loans repayable within one year	*(7 636)*	12 013	5 297	*(6 570)*	8 715
Increases in capital and share premium	6 315	5 166	4 486	541	1 515
Other	1 003	146	269	3	*(605)*
	20 253	39 579	30 832	37 885	32 233
APPLICATION OF FUNDS					
Capital expenditure	13 525	19 653	26 144	28 206	24 254
Increase in working capital	11 171	16 075	4 225	5 385	5 183
Increase in investments	*(4 537)*	243	*(1 035)*	1 437	2 864
Goodwill arising on acquisitions	89	3 608	1 438	2 857	1 932
	20 253	39 579	30 832	37 885	32 233

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BOC principal products and services

Gases Division

Industrial Gases
The supply from some 60 distribution depots covering the UK and the Republic of Ireland, of liquid or compressed gases for welding, cutting, process and space heating, inert atmospheres and a wide range of applications throughout industry. The range of products supplied includes oxygen, nitrogen, argon, acetylene, propane, butane, carbon dioxide, Freon, hydrogen, and other fuel gases; shielding gas mixtures for arc welding.
The supply and installation of gas storage and distribution systems on customers' premises.
Ownership and operation of 40 air separation tonnage plants with a total product capability of more than 17 000 tons a day, about 50 cylinder filling stations, acetylene plants, propane cylinder filling stations, hydrogen plants etc., also a specialised transport fleet of over 1 300 road vehicles and trains of 100-ton cryogenic rail tank cars.
Major pipeline grids deliver oxygen direct to customers' works in the Sheffield, Wolverhampton, Tees-side and Motherwell industrial areas.

Special Gases
The supply through the industrial gas distribution depots of:
Ultra high purity atmospheric and rare gases.
Helium in cylinders, tube trailers, small cryogenic vessels and bulk liquid tanks, and liquid hydrogen.
A range of 130 gaseous chemicals.
Tailor-made mixtures of any number of gases including radioactive gases to very high standards of accuracy.
Supply of complete range of equipment for gas handling, purification, safety and pollutants.

Medical Gases
The supply, from some 30 depots covering the UK, of liquid or compressed gases for anaesthesia, analgesia, oxygen therapy and resuscitation in the medical and dental fields, also a full range of diving gases. Products include: oxygen, nitrous oxide, Entonox, cyclopropane, carbon dioxide, compressed air and helium; oxygen/carbon dioxide and oxygen/helium mixtures, special mixtures to customers' specification.

Food Processes
Liquid nitrogen deep-freezing, cooling and transport refrigeration systems. Systems using inert gases to increase shelf life and improve quality in packaged foodstuffs.

Industrial Services
Design and installation of compressed natural gas, liquid natural gas and liquid petroleum gas plant including burners, controls and ancillaries.
Gas ballasting and simulated natural gas satellite stations.
Liquid petroleum gas/air mix plant, natural gas pressure reduction stations, control and conditioning equipment.
Bulk transportation of liquid fuel gases and specialised chemicals.
Uplift, removal and reinstallation of complete factories, process plants, or individual plant items and ancillaries, maintenance and overhaul services to industrial suppliers and users of mechanical process and chemical plant, including all associated electrical components, instrumentation, pipework, specialised welding and ancillaries.
Specialised low temperature custom grinding of rubber, plastics, paint, adhesives, pharmaceuticals, foods and spices.
Concrete hole boring services, including thermic lancing.

Customer Installation Engineering
Design, supply, installation and maintenance of specialist pipelines and bulk storage facilities for industry, commerce and hospitals; covering all industrial, medical, and rare gases, compressed air, vacuum, cryogenics and other systems.
24 hour industrial and medical maintenance and emergency breakdown services provided throughout the UK as well as planned preventive maintenance.

Seaflame Company Ltd
(Joint venture with the Donald Cameron Group)
Domestic and industrial conversions for use of natural gas.
Vehicle repairs and servicing. Domestic appliance servicing.

Welding Products Division

Welding Products Division provides a complete service to industry from 11 manufacturing and 4 major warehousing establishments via 42 sales distribution points and over 200 distributor outlets in the UK. It runs training centres for process and safety instruction in North London, Birmingham, Manchester and Milton Keynes, and has one of the most comprehensive research and development organisations in Europe in the fields of welding and cutting technology, which has produced many new developments, including laser cutting. Products are exported direct or via overseas subsidiary companies.

Gas Equipment
Manufacturers of gas welding, cutting and flame scarfing equipment, torches, regulators, gauges, portable control units.
Suppliers of gas handling equipment, manifolding, gas welding [illegible] Liquefied petroleum gas welding equipment, hoses and the assembly of gas welding sets. Design and installation of pipelines, manifolds and control panels to customers' specifications.

Thermal Cutting Machines and Steelworks Equipment
Manufacturers of a wide range of gas, plasma and laser cutting machines from portable models to ratio and numerically controlled cross carriage machines, also heavy cutting rigs, and suppliers of hot and cold scarfing machines and hot cropping machines for steelworks.

Arc Equipment
Manufacturers of transformer, rectifier and generator welding power units for manual and automatic MIG (metal inert gas), MAG (metal active gas), TIG (tungsten inert gas) plasma, underwater equipment and power units, and plasma and gouging equipment.

[illegible] Manufacturers of [illegible] welding equipment, [illegible] specialist installations.

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BOC principal products and services

Arc Welding Consumables
Manufacturers of BOC Murex welding electrodes for manual arc welding; continuous covered electrodes, submerged arc wires, tubular electrodes and powders for automatic welding; gas shield wires and tubular electrodes for semi-automatic welding.

Workshop Supplies
Suppliers of all types of welding accessories, a wide range of industrial protective clothing and equipment and a range of engineers' consumables such as cutting tools, abrasives, hand tools and power tools.

[illegible] Welding Ltd
Re[illegible] welding equipment, [illegible] welding machines, manufacturing equipment and [illegible]

Smit Weld BV Hellevoetsluis
Joint venture with Hoke AG of the Netherlands
Manufacturers of a wide range of electrodes [illegible] and special applications. Manufacturers of [illegible] welding powders; of special consumables for [illegible]. Suppliers of BOC gas and arc equipment in [illegible] West Germany.

Advanced Engineering Division

Medical and Aviation Equipment—Harlow
Manufacturers and suppliers of anaesthetic, analgesic and oxygen therapy equipment, respirators and resuscitators, medical pipeline systems, dental and obstetric apparatus, intensive care and inhalation therapy equipment, electronic monitoring equipment, including patient monitoring equipment.

Aviation equipment covers liquid and gaseous oxygen systems with associated breathing equipment for crew and passengers of military and civil aircraft. Liquid and gaseous production plants, storage tanks, dispensing equipment. Liquid nitrogen airborne equipment for fuel tank inerting, liquid/gas evaporative cooling, etc.

Saccab SpA (Italy)
Manufacturers and distributors of anaesthetic equipment and accessories, medical pipelines, inhalation therapy equipment, medical electronics for intensive care and diagnostics, heart pacemakers, emergency ambulance equipment, lung ventilators.
Manufacturers of nitrous oxide.
Branch offices in 12 major Italian cities with complete coverage of national territory.

BOC Medizintechnik
BOC's medical marketing organisation in West Germany.

Cyprane Ltd
Manufacturers and suppliers of anaesthetic and analgesic equipment, vaporizers and related equipment including gas mixing devices for hospital and dental use. *Anaesthetic Equipment Ltd.*, a wholly owned subsidiary specialising in dental equipment.

Fraser Sweatman (Canada) Ltd and Fraser Sweatman Inc, USA
Vaporizers and anaesthetic and analgesic equipment for general medical, dental and veterinary applications.
Distributors of Cyprane's dental and veterinary products.

Associated British Hospital Equipment Ltd (ABHEL)
Contracts for the whole range of hospital equipment, for constructing new hospitals and major hospital expansion projects.

Edwards High Vacuum International Group
Vacuum processing plant, thin film deposition systems, heat treatment and melting furnaces, freeze dryers and special pumping systems, contract vacuum brazing and thin film coatings, vacuum pumps and accessories, mechanical pumps, vapour diffusion pumps and ultra-high vacuum pumps and systems.

Instruments: Vacuum gauges, monitoring and control equipment, mass spectrometers and accelerated ion-beam devices.

Cryoproducts: Superinsulated dewars and accessories for storage and dispensing of liquid nitrogen, liquid air, liquid natural gas and liquid helium for a wide range of applications. Equipment for cryogenic liquid production and use, including vacuum insulated pipelines and air-heated vaporizers. Helium gas recovery units.

Factories: Crawley, Shoreham and Eastbourne.
Also: *Edwards High Vacuum (Canada) Ltd, Edwards Hochvakuum, Edwards Alto Vuoto SpA and Edwards High Vacuum Inc.*

Nissan Edwards Shinku KK (Japan)
Manufacturers and distributors of vacuum equipment.

Madef S/A Indústria e Comércio, Brazil
Manufacturers and distributors of industrial refrigeration equipment.

Sparklets UK
Sparklets soda syphons and CO_2 bulbs. Drink concentrates. Beertap, icebowls, wine racks, vacuum jugs. Corkmaster. Home Brew beer and wine kits and equipment. Cream whippers and bulbs. Camping appliances. Small CO_2 cylinders for fire extinguishers and other industrial appliances.

Leland Industries Inc (USA)
Marketing of the Sparklets and Heimsyphon range in USA.

Heimsyphon (West Germany)
Soda syphons and bulbs, drink concentrates, cream whippers, wine racks, ice trays, beer dispensing equipment for home use.

Chemicals Division

British Oxygen Chemicals Ltd
Melamine. Tall oil rosin and fatty acids—used in paper-making, paints, plastics and industrial soaps. Pressure sensitive adhesive emulsions. Polyvinyl pyrrolidone—used in cosmetics and toilet requisites. Agents for dicyandiamide, benzo guanamine and sucrose benzoate.

British Solvent Oils Ltd
Rubber compounding aids including plasticisers and peptizers: automotive and general machine lubricants and construction chemicals.

British Oxygen Magdeburg Ltd
Acetylene for neoprene manufacture. Bulk LPG depot and handling facility.

Odda Smelteverk A/S (Norway)
Calcium carbide and derivatives—dicyandiamide and calcium cyanamide.

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BOC principal products and services

Metals Division

Murex Ltd
Alloys and chemical derivatives of a range of metals including: molybdenum, tungsten, tantalum, niobium and vanadium. Refractory metal powders.
Tungsten carbide and hard metal powders.
Metal alloys.
Separation and conversion of ores.
Thermit compounds.

Production Tool Alloy Ltd
Hard metal products including: tools, tips and dies (marketed under Perpro and Prolite marks). Sintered permanent magnets.

Thermit Welding (GB) Ltd
Sale of compounds and equipment for thermit welding. Rail welding and repairs by thermit welding process.

Deloro Stellite (UK) Ltd
Manufacturers of a wide range of components in cast 'Stellite'. Surgical implants. Hardfacing rods.
Comprehensive service in 'Stellite' coating.
Also: *Stridsberg-Deloro AB (Sweden).*

High Speed Steel Alloys Ltd
Inorganic chemicals based on tungsten, molybdenum, vanadium. Ferro alloys. Tungsten metal and carbide powders.

Blackwells Metallurgical Works Ltd
Manufacturers of aluminium hardeners and other melted alloys.

BOC Minerals
Purchasing and trading in mineral ores, metals and metallic salts.

Food Services Division

Ace Refrigeration Ltd
Wholesale distribution of a variety of domestic deep freezers.

Batchelors Ltd (Eire)
Processing, canning and bottling of food and beverages.

J. Muirhead Ltd
Marketing and distributing frozen foods and canned goods.

Winchester Frozen Foods Ltd
Freezer and frozen food distributors to the catering and domestic markets.

BOC-Linde Refrigeration Ltd
(Joint venture with Linde AG of Germany)
Commercial and industrial mechanical refrigeration and deep freeze equipment including retail display cabinets.

King Harry Foods
Producers of high-value frozen foods for the retail and catering trade.

El Fresno SA (Spain)
(Joint venture with SA Conserva Extremena of Spain)
Processing and marketing of frozen foods for national and export markets.

BOC Transhield Ltd

Food distribution service to Marks & Spencer's stores.
Specially-equipped vehicles including Polarstream refrigeration operate from strategically placed depots to cover the UK.
General haulage and continental transport service.

Cryoplants Ltd

Cryogenic engineering including air separation plant.
Vacuum insulated evaporators, cryogenic tankers and other plant. Large welded fabrications.

Other trading activities

Cryogenic Refrigeration Systems
Supply of helium liquefiers for capacities between 15 litres/hr and 1000 litres/hr, and helium refrigerators for temperatures down to 1.8 K, and with a refrigerating capacity of a few watts to kilowatts. These are based on the highly reliable BOC [illegible] gas bearing expansion turbines and can operate for long periods unattended. Specialist high reliability small refrigerators for cooling [illegible] amplifiers, [illegible] stages, cold traps, etc. down to 1.5 K. Helium purification systems.

Industrial Laser Systems
Supply of laser cutting systems for metals and non-metals based on 2-kilowatt BOC gas laser. Supply of 2-kilowatt lasers for general use.

Underwater Welding Services
Provision of service for underwater inspection and welding repair operations, using improved and recently developed underwater welding techniques.

Medistore (UK) Ltd
Micro-Aire combined microwave and hot air electronic ovens for the catering industry.

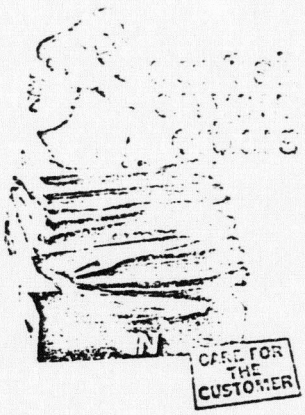
Electron Beam
[illegible] supply of [illegible] equipment [illegible] and [illegible] for production [illegible] supply of [illegible] for [illegible] or sterilization. Electron beam welding [illegible]

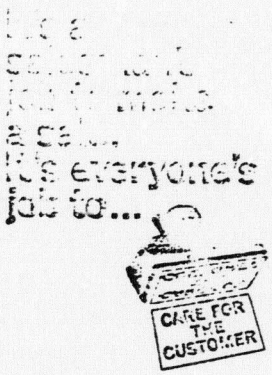
Vacuum Services
[illegible] vacuum [illegible] and [illegible] equipment [illegible] and [illegible] [illegible] [illegible]

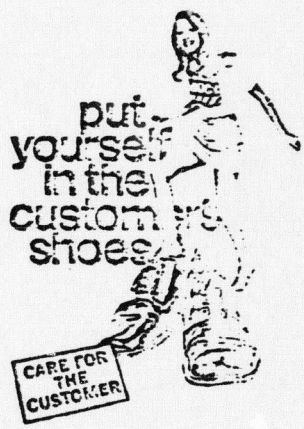
A 3747

'Care for the customer'

CX-11-2-10







The Care for the Customer campaign was devised to impress upon all who work for BOC, particularly those who do not have direct customer contact, that customers are the Company's life blood and that the attitude of every single employee affects our customer relations. It was not merely a campaign for greater courtesy but a means of emphasizing that satisfying customer needs should be a way of life for all BOC people, whether they are designing or making products, delivering or selling them, compiling accounts or manning telephone switchboards.

Although inspired from Head Office, the campaign was activated by campaign managers in every Division. They devised their own programmes, based on the national theme, to meet local conditions. They were supported by publicity material, some examples of which are shown here.

The staff newspaper, *Pennant*, has also been used to promote the campaign, and feed-back from its reporters has produced both useful ideas for overcoming obstacles to good customer service and encouraging news about the success of the campaign.

Illustrations Tom Wilson Ltd 742

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Shareholders' information

Dividend and interest payments

Ordinary Shares
Interim announced June paid October
Final proposed December paid March

Preference Stocks
Paid half yearly, 30th June, 31st December

5¾% and 6¾% Debenture Stocks
Paid half yearly, 15th May, 15th November

8½% and 11% Tonnage Debenture Stocks
Paid half yearly, 15th June, 15th December

7¼% Unsecured Loan Stock
Paid half yearly, 15th January, 15th July

Announcement of Group results

Three months' results March
Half year's results June
Nine months' results September
Year's results December
Report and Accounts February

Capital Gains Tax

For capital gains tax purposes the market values of BOC Ordinary shares, Preference stocks and Loan stocks at 6th April 1965 were:
Ordinary shares of 25p 45·3125p
6½% Cum pref stock £1 units 98·75p
5% Cum 2nd pref stock £1 units 72·5p
4% Cum 2nd pref stock £1 units 56·25p
5¾% Debenture stock 1981/86 £87
6¾% Debenture stock 1985/90:
fully paid £99½
£50 paid £51½
The Company is not a close company within the meaning of the Income and Corporation Taxes Act 1970, and there has been no change in that status since 30th September 1972.

ANALYSIS OF THE HOLDINGS OF ORDINARY SHARES OF 25P EACH FULLY PAID AS AT 30TH SEPTEMBER 1972

Size of holdings 25p shares	Number of accounts	Per cent of total number of accounts	Number of 25p shares	Per cent of ordinary capital	Average holding 25p shares
1–500	24 175	44	8 508 622	4	[illegible]
501–1 000	16 787	22	12 [illegible] 032	6	[illegible]
1 001–5 000	23 789	30	59 [illegible] 225	24	[illegible]
5 001–50 000	2 709	3	38 [illegible] 824	19	[illegible]
50 001–[illegible]	492	[illegible]	58 [illegible] 29	29	[illegible]
over 1 000 000	19	[illegible]	[illegible] 37	22	[illegible]
	77 [illegible]	[illegible]	[illegible]	[illegible]	

[illegible]

A 3749

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A 3750

CX -12-A

29 September 1967

THE BRITISH OXYGEN COMPANY LIMITED

-and-

AIR REDUCTION COMPANY, INCORPORATED

AGREEMENT - JOINT COMPANIES

CX-12-B

A 3751

AGREEMENT

AGREEMENT dated as of September 29 1967 between THE BRITISH OXYGEN COMPANY LIMITED, an English corporation ("BOC"), and AIR REDUCTION COMPANY, INCORPORATED, a New York corporation ("Airco").

W I T N E S S E T H :

WHEREAS, the parties hereto desire to participate in the manufacture and marketing of certain plants and parts thereof (hereinafter called the Product Line and defined in detail in Exhibit A hereto) through BOC-AIRCO Plant Limited, an English corporation (hereinafter called "JVE"). the name of which is to be changed to BOC-AIRCO Cryogenic Plant Limited, and AIRCO-BOC Cryogenic Plants Corporation, a Delaware corporation (hereinafter called "JVA"), each of which will become jointly owned by Airco and BOC pursuant to this Agreement; and

WHEREAS, the parties hereto have agreed to cause JVE and JVA to take all action necessary to complete the transactions contemplated by this Agreement and to adopt such Agreement and to execute all documents to be executed by JVE or JVA, as the case may be, at the Closing (hereinafter defined) or as promptly thereafter as is feasible,

NOW, THEREFORE, in consideration of the premises and the covenants hereinafter contained, the parties hereto agree as follows:

ARTICLE I

A. In addition to the other representations and warranties herein and in the Exhibits hereto contained, BOC represents and warrants that:

(1) Organization and Good Standing of JVE. JVE is a corporation duly organized, validly existing and in good standing under the laws of the United Kingdom and has the corporate power to carry on the business contemplated by this Agreement.

(2) Capitalization of JVE. The authorized capital stock of JVE consists of 750,000 ordinary shares having a par value of £1 per share, divided into 375,000 "A" shares, and 375,000 "B" shares, 225,000 "A" shares and 225,000 "B" shares of which have been validly issued and are now outstanding, fully paid and non-assessable. None of such shares was issued in violation of any of the preemptive rights of any of JVE's shareholders. There are no outstanding subscriptions, options or other agreements obligating JVE to issue any shares of its capital stock.

(3) Memorandum and Articles of Association. The copies of JVE's Memorandum of Association and Articles of Association, as amended to date, which have been delivered to Airco are complete and correct as of the date of this Agreement.

(4) Stockholdings of BOC. BOC is, and on the Closing Date (hereinafter defined) will be, the lawful owner of all of the issued and outstanding shares of JVE and has, and on the Closing Date will have, valid and marketable title to such shares, free and clear of all claims, liens or encumbrances, and full legal right and power and all authorization and approval required by law to sell, assign and transfer such title to 50% of such shares to Airco as provided in this Agreement.

(5) Financial Statements. The Balance Sheet of JVE as of September 1, 1967, (the "Balance Sheet Date"), which has heretofore been furnished to Airco, fairly presents the financial condition of JVE as of the date thereof in accordance with generally accepted accounting principles applied on a consistent basis. At the Balance Sheet Date JVE had no liabilities or obligations of any nature, whether absolute, accrued, contingent or otherwise, or whether due or to become due, except as reflected in the Balance Sheet.

(6) Contracts, Actions. JVE is not a party to any contract or instrument a copy of which it has not provided to Airco and has no actions pending or threatened against it.

(7) Officers and Directors; Banks. Attached hereto as Exhibit B is a list setting forth (i) the names of all directors and senior management of JVE; (ii) the name of each person holding a power of attorney from JVE, and (iii) the name of each Bank in which JVE has any account or safe deposit box and the names of all persons authorized to draw thereon or have access thereto.

(8) No Violation of Law, Etc. Neither the execution and delivery of this Agreement nor the consummation of the transactions herein contemplated will conflict with, or result in a breach by JVE or BOC of, any of the terms, conditions or provisions of, any law, regulation, order, writ, injunction or decree of any court or governmental instrumentality, domestic or foreign, and JVE is not currently in breach of any such law, regulation, order, writ, injunction or decree. Neither the execution and delivery of this Agreement nor the consummation of the transactions herein contemplated will conflict with, or result in a breach by BOC or JVE, of,

any of the terms, conditions or provisions of, any loan agreement, indenture or contract to which BOC or JVE is a party, or of the respective Memoranda and Articles of Association of BOC and JVE.

(9) Taxes. JVE has filed all tax returns and reports required to be filed by it prior to the date of this Agreement, including those for the fiscal year ended September 30, 1966 and has paid all taxes shown thereon, when due. United Kingdom tax returns for JVE have been examined by the Inland Revenue Service for the fiscal year ending September 30, 1966 and no assessment has been made as a result of such examinations.

(10) Absence of Certain Changes or Events. Since the Balance Sheet Date there has been no change in the condition, financial or otherwise, of the assets or liabilities of JVE as reflected in the Balance Sheet except such changes as reflect any transfers made by BOC to JVE pursuant to the provisions of Article II hereof.

(11) Title to Properties. Upon completion of the transfers referred to in Sections B and F of Article II hereof, JVE will have good and marketable title to the real property and personal property referred to therein, free and clear of all liens and encumbrances of any kind except as specified in Exhibit D, and excepting also a lease from JVE to BOC with respect to a portion of such land, buildings and other property, a copy of which has been delivered to Airco by BOC. This warranty shall survive delivery of all instruments of conveyance hereunder.

B. In addition to the other representations and warranties herein and in the Exhibits hereto contained, Airco represents and warrants that:

CX-12-F

(1) Organization and Good Standing of JVA. JVA is a corporation duly organized, validly existing and in good standing under the laws of Delaware and has the corporate power to carry on the business contemplated by this Agreement.

(2) Capitalization of JVA. The authorized capital stock of JVA consists of 1,000 shares of common stock having a par value of $1 per share, divided into 500 "A" shares and 500 "B" shares. None of such shares has been issued. There are no outstanding subscriptions, options or other agreements obligating JVA to issue any shares of its capital stock.

(3) Certificate of Incorporation and By-Laws. The copies of JVA's Certificate of Incorporation and By-Laws, as amended to date, which have been delivered to BOC, are complete and correct as of the date of this Agreement.

(4) JVA has no assets or liabilities or obligations of any nature, whether absolute, accrued, contingent or otherwise, except assets or liabilities resulting from this Agreement.

(5) Contracts, Actions. JVA is not a party to any contract or instrument a copy of which it has not provided to BOC and has no actions pending or threatened against it.

(6) Officers and Directors; Banks. Attached hereto as Exhibit C is a list setting forth (i) the names of all officers and directors of JVA, (ii) the name of each person holding a power of attorney from JVA, and (iii) the name of each Bank in which JVA has an account or safe deposit box and the names of all persons authorized to draw thereon or have access thereto.

(7) No Violation of Law, Etc. Neither the execution and delivery of this Agreement nor the consummation of the transactions herein contemplated will conflict with, or result in a breach by JVA or Airco of, any of the terms, conditions or provisions of any law, regulation, order, writ, injunction or decree of any court or governmental instrumentality, domestic or foreign, and JVA is not currently in breach of any such law, regulation, order, writ, injunction or decree. Neither the execution and delivery of this Agreement nor the consummation of the transactions herein contemplated will conflict with, or result in a breach by Airco of, any of the terms, conditions or provision of any loan agreement, indenture or contract to which Airco is a party, or of the respective Certificates of Incorporation or By-Laws of Airco and JVA.

(8) Taxes. JVA has not been required to file any tax returns prior to the date hereof, and owes no taxes.

(9) Title to Properties. Upon completion of the transfers referred to in Section D of Article II hereof, JVA will have good and marketable title to the real property and personal property referred to therein free and clear of all liens and encumbrances of any kind except as specified in Exhibit E. This warranty shall survive delivery of all instruments of conveyance hereunder.

CX-12-H

ARTICLE II

A. Unless otherwise mutually agreed, a closing or completion with respect to the transactions described in this Article II which have not theretofore been accomplished (the "Closing") shall be held on September 29, 1967 (the "Closing Date"). The Closing shall be held simultaneously at the offices of BOC, Hammersmith House, London W. 6, and at the offices of Airco, 150 East 42nd Street, New York, New York, at 3:00 P.M. London time and 10 A.M. New York time.

B. To the extent not accomplished on the date hereof, BOC will, at or prior to the Closing on the Closing Date, transfer to JVE good and marketable title to:

(1) the land and buildings described in Exhibit D hereto, and

(2) the machinery, furniture, fixtures, vehicles and other property on the books of the Chemical Plants Division of BOC at Edmonton (exclusive of inventory) at September 28, 1967 which shall be substantially the same as the property on such books at August 29, 1967, the date at which the appraisal of such properties for purposes of fixing the purchase price thereof pursuant to this Agreement was commenced by Henry Butcher & Co. on behalf of Airco.

BOC represents and warrants that substantially all property used by the Chemical Plants Division in the manufacture, use and sale of the Product Line on September 28, 1967 was reflected on the books of the said Chemical Plants Division at that date. All property transferred pursuant hereto shall be transferred to JVE free and clear of all liens and encumbrances of any kind (except as specified on Exhibit D and excepting also the lease from JVE to BOC referred to in Article IA (11) hereof) in a manner satisfactory to Airco and its counsel. BOC warrants

(a) that it has a good and marketable title to the land and buildings described in the said Exhibit D

hereto, that any restrictive covenants or conditions affecting the said land and buildings have been observed and will be observed up to the date of transfer to JVE and that it has no notice of any breach of such covenants and conditions.

(b) that the existing use of the said land and buildings is in conformity with all planning legislation and regulation and any development plan applicable thereto and that no enforcement notice has been served upon it and that it has no notice of any infringement of such legislation regulation or development plan and no notice of any development scheme whether under a development plan or otherwise which envisages any compulsory purchase or conflicts with the existing use of the property.

All taxes upon such transfers shall be borne by BOC, except stamp taxes which shall be borne by JVE. The following items shall be apportioned on or before October 30, 1967 as of September 28, 1967: (1) rents; (2) premiums on existing transferable insurance policies which are transferred to JVE; (3) taxes and sewer rents on the basis of the fiscal year for which assessed; (4) water charges; and (5) fuel.

C. The full purchase price to be paid by JVE for all of the land, buildings and other property to be transferred from BOC to JVE pursuant to Section B of this Article II shall be £3,214,000, payable as follows:

(1) As to £450,000: by cancellation forthwith of the debt of this amount owing from BOC to JVE.

(2) As to £1,264,000 On October 31, 1967 without interest; provided, however, that if the payment date is extended by mutual agreement of BOC and JVE, interest shall be payable on the unpaid balance

at the rate of one half per cent per annum over Bank Rate from and after October 31, 1967.

(3) As to £1,500,000: On September 28, 1968 with interest at the rate of 7½% per year from September 29, 1967; provided, however, that such amount shall be prepaid by JVE, with interest thereon to the date of repayment, to the extent of any mortgage loan obtained by JVE after the Closing pursuant to Section A(1) of Article III hereof, within one week after such mortgage loan is obtained.

D. At or prior to the Closing on the Closing Date, Airco will transfer to JVA: (a) good and marketable title to the real property (being the property described in an agreement dated 13 February 1967 and an Indenture dated 27 February 1967 between Airco and Union Oil Company of California, and the personal property described in Exhibit E hereto, free and clear of all liens and encumbrances of any kind except as specified in Exhibit E, and (b) Airco's rights under a certain agreement (the "Construction Agreement") with De Cristofer Construction Company with respect to the construction of an addition to a building on the real property described in Exhibit E hereto. Airco warrants:

(a) that it has a good and marketable title to the land and buildings described in the said Exhibit E hereto, subject to the restrictions set forth therein, that any restrictive covenants or conditions affecting the said land and buildings have been observed and (so far as applicable) will be observed up to the date of transfer to JVA and that Airco

has no notice of any breach of such covenants and conditions

(b) that the existing use of the said land and buildings is in conformity with all applicable zoning legislation and regulation and that no enforcement notice has been served upon Airco with respect to any violation thereof and that Airco has no notice of any infringement of such legislation or regulation and no notice of any proposed legislation or regulation which envisages any compulsory purchase of such property or conflicts with the existing use of such property.

All taxes upon such transfers shall be borne by Airco, except stamp taxes which shall be borne by JVA. The following items shall be apportioned on or before October 30, 1967, as of September 29, 1967: (1) rents; (2) premiums on existing transferable insurance polices which are transferred to JVA; (3) taxes and sewer rents on the basis of the fiscal year for which assessed; (4) water charges; (5) fuel. At or prior to the Closing on the Closing Date JVA will deliver to Airco a consent to the assignment of the Construction Agreement and assumption of the Construction Agreement by JVA in form satisfactory to Airco and its counsel. Promptly after the Closing Airco will assign to JVA all of Airco's rights and obligations under a certain architect's agreement with Kuhn & Drake relating to the premises referred to in the Construction Agreement.

E. The full purchase price to be paid by JVA for all of the property to be transferred by Airco to JVA pursuant to Section D of this Article II shall be $614,540 plus the cost of all modifications to the property (including without limitation, architects fees) since the date of purchase thereof by Airco and paid for or payable by Airco before or after the date hereof. The purchase price shall be payable as follows:

(1) As to the difference between the total purchase price and $550,000 — On October 31, 1967, provided, however, that if the payment date is extended by mutual agreement of JVA and BOC, interest shall be payable on the unpaid balance at one half per cent per annum over prime rate from and after

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October 31, 1967.

(2) At to $550,000

On September 28, 1968, with interest at the rate of 6½% per year from September 28 1967; provided, however, that such amount shall be prepaid by JVA with interest thereon to the date of repayment to the extent of any mortgage loan obtained by JVA after the Closing pursuant to Section A(1) of Article IV hereof, within one week after such mortgage loan is obtained.

F. To the extent not accomplished prior to the Closing on the Closing Date BOC will, at or prior to the Closing on the Closing Date transfer to JVE good and marketable title to all of the inventory of the Chemical Plants Division at BOC's Edmonton Plant free and clear of all liens and encumbrances in a manner satisfactory to Airco and its counsel. Such transfer shall be made on open account. Within ninety (90) days after the Closing Date the auditors of JVE shall approve or amend BOC's valuation of the portion of such inventory which relates to the Product Line (exclusive of any items being held for the benefit of BOC's Gas Division or subsidiaries) at the lower of cost or fair market value as of the Closing Date; provided, however, that no value shall be accorded to any item which would, in accordance with generally accepted accounting principles, be deemed obsolete. Promptly after receipt of such approved or amended valuation JVE shall pay the amount thereof to BOC, as payment in full for such inventory. Any inventory so transferred and not relating to the Product Line or relating to the Product Line and held for the benefit of BOC's Gas Division or subsidiaries shall be reassigned by JVE to BOC unless otherwise agreed.

Within 90 days of the date hereof JVE shall decide whether or not it intends to provide a maintenance and spares service for BOC and its former customers

(1) In the event of JVE deciding to provide such a service:

(a) JVE will take over all BOC maintenance contracts with customers

(b) JVE will keep all inventory items relevant to such contracts

(2) In the event of JVE deciding not to provide such a service:

(a) BOC shall within 12 months of the date hereof take a reassignment of all inventory items referred to in 1 (b) above

(b) Until such reassignment, JVE shall provide the said service to BOC's customers on terms as to payment by BOC to be agreed.

G. At the Closing on the Closing Date:

(1) BOC will sell to Airco 225,000 "B" shares of JVE, having a par value of £1 each and constituting 50% of the total capital stock of JVE. Such shares shall be validly issued, fully paid and non-assessable and shall be sold and delivered free and clear of all liens and encumbrances of any kind except those imposed by this Agreement. At the Closing BOC will deliver a certificate or certificates for such shares to Airco in proper form for transfer, duly endorsed in blank or with duly executed assignments to Airco attached. Such certificate or certificates shall be accompanied by all documents necessary to support the assignment to Airco together with all required stock transfer stamps, the cost of which shall be borne equally by BOC and Airco. Airco will pay for such shares in full by delivering to BOC Airco's certified or bank check in the amount of U.S. $630,000.

(2) The parties will cause JVA to issue and sell to BOC 500 "A" shares of JVA, and to issue and sell to Airco 500 "B" shares of JVA. Each such "A" share and "B" share shall have a par value of $1.00. The 500 "A" shares and the 500 "B" shares so sold shall each constitute 50% of the total issued capital of JVA. All of such shares shall be validly issued, fully paid and non-assessable and shall be sold and delivered free and clear of all liens and

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encumbrances of any kind except those imposed by this Agreement. At the Closing JVA will deliver a certificate or certificates for such shares to BOC in proper form for transfer, duly endorsed in blank or with duly executed assignments to BOC attached. Such certificate or certificates shall be accompanied by all documents necessary to support the assignment thereof to BOC together with all required stock transfer stamps, the cost of which shall be borne equally by BOC and Airco, and BOC will pay for such shares in full by delivering to JVA BOC's certified or bank check in the amount of $115,000.

(3) BOC and Airco shall license JVA and JVE under their respective patent rights and know-how by executing Licence Agreements in substantially the form of Exhibit F.

H. The parties hereto shall use their voting power as shareholders to cause JVA and JVE to take all action necessary to complete the transactions contemplated by this Agreement and to adopt such Agreement and to execute all documents to be executed by JVE or JVA, as the case may be, at the Closing or as promptly thereafter as is feasible.

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ARTICLE III

A. Promptly after the Closing, JVE shall:

(1) Borrow the maximum amount obtainable from banks or other lending institutions upon the security of a mortgage of all or any part of JVE's land, buildings and machinery. The terms and conditions of such borrowing and mortgage shall be subject to the approval of JVE's Board of Directors. The proceeds of such borrowings shall first be used to pay before due date the amount due to BOC referred to in Article II C (3) hereof and interest thereon to the date of repayment and any remainder shall be added to the general funds of JVE.

(2) Borrow by means of bank overdrafts the amount necessary to pay the amount due to BOC under Article II C (2) hereof and interest thereon on any amount unpaid from October 31, 1967 to date of repayment.

B. BOC and Airco shall each guarantee 50% of JVE's overdraft borrowings (including the borrowing referred to in Section A (2) of this Article III) in such form as the lender may require and as is usual in such transactions up to maximum borrowings by JVE of £4,000,000.

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ARTICLE IV

A. Promptly after the Closing JVA shall:

(1) Borrow the maximum amount obtainable from banks or other lending institutions upon the security of a mortgage of all or any part of JVA's land, buildings and machinery. The terms and conditions of such borrowing and mortgage shall be subject to the approval of JVA's Board of Directors. The proceeds of such borrowings shall first be used to pay before due date the amount due to Airco referred to in Article II E (2) hereof and interest thereon to the date of repayment and any remainder shall be added to the general funds of JVA.

(2) Borrow from banks or other lending institutions the amount necessary to pay the amount due to Airco under Article II E (1) hereof and interest on any amount unpaid after October 31, 1967 to date of repayment

B. BOC and Airco shall each guarantee 50% of JVA's borrowings from banks and other lending institutions (including the borrowings referred to in Section A(2) of this Article IV) in such form as the lender may require and as is usual in such transactions up to maximum borrowings by JVA of $2,000,000.

ARTICLE V

A. All obligations of each of the parties hereto under Article II of this Agreement are subject to the fulfilment at or prior to the Closing on the Closing Date of each of the following conditions, except, with respect to either party, to the extent that any such condition has been waived in writing by such party:

(1) There shall have been obtained all consents and approvals of the governments of the United Kingdom and of the United States or of any agency of either of such governments or of any political sub-division thereof necessary or advisable, in the opinion of counsel to either party, to the execution or performance of this Agreement or to the execution or performance of any of the proposed agreements or instruments annexed as Exhibits hereto.

(2) On the Closing Date, there shall be no litigation or proceeding before any court, arbitrator, governmental commission, board or other agency, pending or threatened, which may result in any material adverse change in the overall condition, or properties or proposed business of JVE or JVA and there shall be no litigation before any court or a proceeding before any such commission, board or agency, pending or threatened, against either party hereto, JVE or JVA, in which it is sought to restrain or prohibit, or to obtain damages or other relief in connection with, the consummation of the transactions contemplated by the parties herein.

(3) The consummation of the transaction contemplated herein shall not conflict with or result in a breach by either party hereto, JVE or JVA, of any of the terms, conditions or provisions of any law, regulation, order, writ, injunction or decree of any court, government or governmental instrumentality, domestic or foreign, nor shall it conflict with any restriction, covenant or contract to which either party hereto, JVE or JVA, are parties or by which they are bound.

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B. All obligations of BOC under this Agreement are subject to the fulfilment at or prior to the Closing on the Closing Date of each of the following conditions, except to the extent that any such condition has been waived in writing by BOC:

(1) All representations and warranties of Airco contained in this Agreement and in the Exhibits hereto shall be true and correct on and as of the Closing Date as though such representations and warranties had been made on and as of such time.

(2) All covenants and agreements required by this Agreement to be performed and complied with by Airco prior to or at the Closing shall have been duly complied with and performed by Airco.

(3) BOC shall have received copies of the written resignations of the officers and directors of JVA effective as of the Closing Date.

(4) All corporate and other proceedings to be taken by Airco or JVA in connection with the transactions contemplated hereby and all documents incident thereto shall be reasonably satisfactory in form and substance to BOC and its counsel, and BOC and its counsel shall have received all such documents and other evidence as they may reasonably request in order to establish the consummation of such transactions and the taking of all corporate proceedings in connection therewith.

(5) BOC shall have received an opinion from Messrs Shearman & Sterling, counsel for Airco, dated the Closing Date, in form and substance satisfactory to it and to its counsel that the execution, delivery and performance of this Agreement by Airco have been duly authorised and approved by all requisite action of Airco's Board of Directors and stockholders and that this Agreement has been

duly executed and delivered by Airco and that upon the issuance and sale to BOC of the shares of common stock of JVA to be issued and sold to BOC hereunder, and the delivery to BOC of the certificate or certificates representing the same, BOC will have valid and marketable title to such shares free and clear of all claims, liens or encumbrances other than those imposed by this Agreement.

C. All obligations of Airco under this Agreement are subject to the fulfilment at or prior to the Closing on the Closing Date, of each of the following conditions, except to the extent that any such condition has been waived in writing by Airco:

(1) All representations and warranties of BOC contained in this Agreement and in the Exhibits hereto shall be true and correct on and as of the Closing Date as though such representations and warranties had been made on and as of such time.

(2) All covenants and agreements required by this Agreement to be performed and complied with by BOC prior to or at the Closing, shall have been duly complied with and performed by BOC.

(3) Airco shall have received copies of the written resignations of the "B" directors of JVE effective as of the Closing Date.

(4) All corporate and other proceedings to be taken by BOC or JVE in connection with the transactions contemplated hereby and all documents incident thereto shall be reasonably satisfactory in form and substance to Airco and its counsel, and Airco and its counsel shall have received all such documents and other evidence as they may reasonably request in order to establish the consummation of such transactions and the taking of all corporate proceedings in connection therewith.

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(5) Airco shall have received an opinion from Messrs Linklaters & Paines, counsel for BOC, dated the Closing Date, in form and substance satisfactory to it and to its counsel that the execution, delivery and performance of this Agreement by BOC have been duly authorized and approved by all requisite action of BOC's Board of Directors and stockholders and that this Agreement has been duly executed and delivered by BOC and that upon the sale and transfer to Airco of the shares of common stock of JVE to be sold and transferred to Airco hereunder, and the delivery to Airco of the certificate or certificates representing the same, Airco will have, subject to the registration of the transfer, valid and marketable title to such shares free and clear of any claims, liens and encumbrances other than those imposed by this Agreement.

ARTICLE VI

A. Nothing in this Agreement shall be deemed to require either Airco or BOC to provide capital, loans or guaranties to either JVE or JVA except as expressly provided herein. Any further capital, loans or guarantees of loans provided by others, which the parties may subsequently agree to provide shall, however, be provided equally by Airco and BOC. All loans from BOC or Airco to JVE or JVA shall be at the same interest rates and on the same terms and conditions as are offered by third party lenders for similar loans to similar borrowers at the time such loans are made. All other transactions between JVE and JVA or between either of them and BOC or Airco shall be on an arm's length basis.

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ARTICLE VII

A. All work in process at BOC's Edmonton Plant (which plant is to be transferred to JVE pursuant to Article II B hereof) on the Closing Date will be completed by JVE in accordance with contractual terms binding on BOC for the account of BOC and BOC will finance such work in process by 100% progress payments to be made monthly. JVE will be responsible for any warranties or performance guarantees with respect to such work.

B. All work in process at Airco's Murray Hill facility, (which facility is to be transferred to JVA pursuant to Article II D hereof) on the Closing Date will be completed by JVA in accordance with contractual terms binding on Airco for the account of Airco and Airco will finance such work in process by 100% progress payments to be made monthly. JVA will be responsible for any warranties or performance guarantees with respect to such work.

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ARTICLE VIII

A. JVE and JVA shall each have a seven (7) member Board of Directors composed of the same persons. BOC and Airco shall each be entitled to nominate three (3) persons for election to the Board of JVE and the same three (3) persons for election to the Board of JVA. BOC and Airco shall jointly nominate a person to be the seventh member of the Board of JVE and JVA and such joint nominee shall be the Managing Director of JVE and President of JVA. BOC and Airco shall vote their respective shares in JVE and JVA to elect the persons so nominated to such offices.

B. BOC shall be entitled to designate one of its three (3) nominees to serve as Chairman of the Board of JVE and of JVA for the fiscal year of each company ending on September 30, 1968, and in alternate fiscal years thereafter. Airco shall be entitled to designate one of its three (3) nominees to serve as Chairman of the Board of JVE and JVA for the fiscal year of each company ending on September 30, 1969, and in alternate years thereafter. BOC and Airco shall vote their respective shares of JVE and JVA and shall take such other steps as may be necessary to cause the person so nominated to be Chairman of the Board of JVE and JVA to be elected to such offices.

C. In the event of the resignation, removal, death or disability of any director of JVE and JVA nominated by one of the parties hereto in accordance with Section A of this Article VIII, such party shall be entitled to nominate another person to fill such positions and BOC and Airco shall vote their respective shares of JVE and JVA to elect the person so nominated to such offices for the remainder of the unexpired term. In the event of the resignation, removal, death or disability of the person designated to serve as Chairman of the Board of JVE and JVA during his term of office, the

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party hereto who nominated such Chairman shall be entitled to nominate another director nominated by such person to be Chairman of the Board of JVE and JVA for the remainder of the term of office of such Chairman. In the event of the resignation, removal, death or disability of the person then serving as Managing Director of JVE and President of JVA, the parties shall jointly nominate and elect a person to such offices for the remainder of the unexpired terms in the same manner as provided in Section A of this Article VIII.

ARTICLE IX

A. BOC and JVE will arrange, to the maximum extent feasible, to enable employees transferred from BOC to JVE to remain members of BOC Staff and Works pension funds. JVE shall bear the employers contribution towards the cost of pension benefits at levels existing at the time of transfer for the period during which such persons are employees of JVE. A determination as to how the cost of any improved benefits shall be borne shall be made by agreement between BOC and JVE. In all other respects the terms of employment of employees transferred from BOC to JVE shall be no less favourable than those which they enjoyed as employees of BOC at the time of transfer.

B. Airco and JVA will arrange, to the maximum extent feasible, to enable employees transferred from Airco to JVA to remain members of Airco's pension plan. JVA shall bear the employers' contribution towards the cost of pension benefits at levels existing at the time of transfer for the period during which such persons are employees of JVA. A determination as to how the cost of any improved benefits shall be borne shall be made by agreement between Airco and JVA. In all other respects the terms of employment of employees transferred from Airco to JVA shall be initially no less favourable than those which they enjoyed as employees of Airco at the time of transfer.

C. No person holding a position in Airco or any of its affiliates or in BOC or any of its affiliates may hold at the same time a paid position, other than that of member of the Board of Directors or of a Committee thereof, in JVE or JVA.

D. Airco and BOC will make their central services and advisory departments available to JVE and JVA to the maximum extent feasible, subject to payment of reasonable compensation for such services by JVE and JVA.

E. The Chief Executive Officer of JVE and JVA shall prepare and make available to BOC and Airco all appropriate financial information required by the parents.

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ARTICLE X

A. Neither Airco nor BOC shall sell, assign, pledge or otherwise transfer any legal or beneficial interest in any or all of its shares in JVE or JVA to any third party (including any subsidiary, affiliate or nominee) except to a successor to substantially its entire business without the written consent of the other party. In the event of the transfer of such shares held by either party hereto to a successor to substantially its entire business, the transferee shall assume all of the rights and obligations under this Agreement of the party hereto making such transfer. Any purported transfer in violation of this provision shall be void and shall not be registered by JVE or JVA as the case may be.

All certificates representing shares of JVA (including those sold pursuant to the provisions of Article II hereof) shall have inscribed thereon the following legend:

> "Sale, assignment, transfer, encumbrance or other disposition of any legal or beneficial interest in the shares of stock represented by this certificate is restricted by and subject to provisions in the Corporation's Certificate of Incorporation which prohibits such transfers to persons not already stockholders without the written consent of all stockholders, and to all of the provisions of a certain agreement between Air Reduction Company Incorporated and The British Oxygen Company Limited dated 29 September 1967 a copy of which is on file at the office of the Corporation/Company."

All certificates representing shares of JVE (including those sold pursuant to the provisions of Article II hereof) shall bear substantially the same legend except that the reference to Certificate of Incorporation shall be changed to Articles of Association.

ARTICLE XI

A. Either party may serve upon the other party a dissolution notice which shall be effective as of the end of the fiscal year immediately following the fiscal year in which it is served provided that no such notice shall be effective prior to September 30, 1975, except as provided in Section E of this Article XI. Within ninety (90) days after a dissolution notice becomes effective:

(1) The auditors of JVE and JVA respectively shall submit to Airco and BOC per share valuations of the shares of JVE and JVA. Such valuations shall be arrived at by dividing the number of outstanding shares of the respective companies into the sum of the following:

(a) The appraised fair market value of such company's assets (exclusive of goodwill, patents and know-how) minus its liabilities, as established by its auditors as of the effective date of the dissolution notice; plus

(b) Five (5) times the amount by which the average annual profit after taxation for the three (3) year period ending on the effective date of the dissolution notice exceeds the average obtained by multiplying the sum of the balance sheet value of shareholders' equity at the commencement of each of such years by 8% and dividing the product by 3.

(2) Within three (3) months after the submission of such valuations the recipient of the notice shall either:

(a) Elect to purchase at the valuations established by the foregoing formula all of the shares in both JVE and JVA held by the party which served such notice; or

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(b) Reject such notice. If no election is made within such three (3) month period the dissolution notice shall be deemed to have been rejected.

(3) Following the rejection of a dissolution notice, the party who served the said notice shall have the right, during the thirty (30) day period immediately following such rejection, to purchase, at the valuations established by the foregoing formula, all of the shares of both JVE and JVA held by the party who rejected such dissolution notice.

B. In the event that after a notice of dissolution is served neither party purchases the other party's shares in JVE and JVA pursuant to the procedure outlined above, the following procedure shall be followed if initiated by either party within thirty-one (31) days following the expiration of the thirty (30) days period referred to in (3) above. A party desiring to terminate the joint venture shall so notify the other party in writing. Within thirty-two (32) days thereafter, each party will submit separate offers to purchase the shares in JVE and JVA held by the other party for cash payable as hereinafter provided. Such offers shall be exchanged simultaneously. The bids for JVE and JVA shall be considered separately. The party making the higher offer for the shares of either company shall have the right to purchase the other party's shares in such company for the amount of such higher offer by payment in cash within thirty-three (33) days following the exchange of offers. If such purchase is not effected within such period the party making the lower offer shall be entitled to purchase the other party's shares in such company at such lower price by payment in cash within the thirty-four (34) days next following. If no purchase of the shares of either such company is effected within the period last specified the parties shall promptly thereafter take such steps as are necessary to dissolve and liquidate such company.

C. A party purchasing the other party's shares in JVE and JVA or either of them pursuant to any of the above procedures shall also, concurrently with such purchase, assume all loans (other than trade balances) which such party has made to such company

and all guarantees which such other party has made to third parties with respect to the obligations of such company.

D. A party selling its shares pursuant to any of the above procedures will, to the extent feasible, transfer or permit employees of JVE or JVA to transfer all amounts in its pension fund which are allocable to employees of JVE or JVA at the time of purchase to the pension fund or plan which is to be used by the purchasers, JVE, or JVA, as the case may be, to provide pensions for such employees. The party purchasing the other party's shares shall take steps to insure, to the extent feasible, that no employee of JVE or JVA will suffer any loss or reduction of pension rights by reason of any sale pursuant to any of the above procedures. Nothing herein shall be construed to require either party hereto, JVA or JVE, to violate any law or regulation or the provisions of any pension trust or agreement or similar instrument or to incur any unusual expense or to retain any employee.

E. Notwithstanding the foregoing provisions of this Article XI a dissolution notice may be served at any time before or after September 30, 1975, in the following circumstances :

(1) In the event that at any time the restrictions imposed on JVE and JVA by the provisions of Article XIII A(2) or (3) prove or threaten substantially to restrict the activities or profitability of BOC or JVE, BOC may serve a dissolution notice which shall be effective as of the end of the fiscal year immediately following the fiscal year in which it is served as above provided; and

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(2) In the event that either party hereto proposes to assign or transfer its shares in JVE or JVA to a successor to all of such party's business or assets, such party shall give twenty-one days notice thereof to the other party hereto and such other party shall be entitled to serve a dissolution notice which shall be effective seven days after it is served.

In the event of a dissolution notice being served pursuant to the provisions of this Article XI E, the parties shall disregard the procedure described in Article XI A(1) hereof and shall proceed directly to the procedure described in Article XI B.

F. Neither party shall be bound to transfer any shares pursuant to this Article unless and until the party requiring such transfer shall first have obtained all necessary permits and authorities under any Exchange Control or other regulations of the UK or US governments then in force. The other party shall co-operate fully in obtaining any such required consents.

ARTICLE XII

A. Airco and BOC each agree that it will purchase from JVE and JVA all of its requirements for the products and services included within the Product Line provided that JVE and JVA have (jointly or separately) the technical capability and physical capacity to design, manufacture, and install the particular Product Line items involved within normal delivery periods for comparable equipment. Whether JVE and JVA have such technical ability and physical capacity shall be determined by their respective boards. Airco and BOC shall pay therefor prices substantially the same as bona fide commercial prices prevailing in the world market for comparable products and services offered by responsible and established suppliers of such products and services. JVE and JVA shall fill all orders from Airco and BOC provided, however, that JVE and JVA will not be required to sell tankage items pursuant to this provision and if JVE and JVA elect not to fill any order for such tankage items at such competitive prices, Airco and BOC may purchase the tankage items covered by such order from other suppliers. Airco and BOC will use their best efforts to cause their subsidiaries to purchase the products and services included within the Product Line, including tankage items, in accordance with the provisions of this Article XII; provided, however, that this shall not be deemed to require Airco or BOC to use their voting power in such subsidiaries to cause them to make any such purchases.

BOC may at any time after the expiration of two years from the date hereof, give one year's notice that it desires to terminate its obligation to purchase its tankage requirements from JVE and JVA. Promptly after service of such notice the parties shall cause an appraisal to be made of all of

the fixtures, machinery, equipment and inventory at the Edmonton Plant relating to the production and sale of tankage items and BOC shall purchase all such property from JVE at such appraised value and shall pay therefor in cash. Airco shall be released from its obligation to purchase its tankage requirements from JVE and JVA one year after the date notice is served by BOC or on the date on which BOC purchases the aforementioned property from JVE, whichever first occurs. BOC shall be released from its obligation to purchase its tankage requirements from JVE upon its purchase of the aforementioned property from JVE. Nothing in this paragraph shall be deemed to affect the provisions of this Article relating to items within the Product Line other than tankage items.

The provisions of this Article XII shall continue in full force and effect for so long as each party hereto continues to hold 50% of the outstanding stock of JVE and JVA and for two (2) years thereafter notwithstanding the termination of any or all other provisions of this Agreement.

ARTICLE XIII

A. Neither party hereto will commit or omit any act or cause or permit JVA or JVE to commit or omit any act the commission or omission of which would cause the other party hereto, JVE or JVA, to be in violation of any law or regulation to which such corporation is subject. Without limiting the generality of the foregoing, the laws and regulations referred to herein shall include:

(1) The exchange and export control regulations of the United Kingdom;

(2) The regulations of the Bureau of International Commerce of the Department of Commerce of the United States of America; and

(3) The Foreign Assets Control and Foreign Transactions Control Regulations of the Treasury Department of the United States of America.

B. Neither party hereto shall be liable for failure to perform its obligations under this Agreement to the extent that, and so long as, such performance is hindered or prevented by any cause constituting force majeure. As used herein, force majeure includes strikes, lockouts and labour disturbances; acts of God and unavoidable accidents, laws, decrees, resolutions and orders of any national, provincial or municipal authority or agency or agencies thereof; acts of war or conditions arising out of or attributable to war (whether declared or undeclared), revolution, insurrection or riots; shortage of necessary materials, equipment or labour or restrictions thereon or limitations upon the use thereof; delays in transportation and/or any other cause, whether or not similar to those enumerated herein, which is beyond the control of the party whose performance is thereby hindered or prevented.

C. All notices and demands which shall or may be given pursuant to this Agreement shall be in writing and shall be delivered in person or by prepaid registered air-mail, addressed to the recipient at its address first above stated and shall be deemed served on the day on which personally delivered or, if delivered by airmail on the fifth day after being posted, or on the day of actual receipt, whichever is earlier. Either party hereto

may change its address for the receipt of notices and demands by notice duly given to the other party pursuant to this Article XIII.

D. This Agreement shall inure to the benefit of and be binding upon the parties hereto and their respective legal representatives, successors and assigns, provided that any assignment of this Agreement or any rights hereunder, whether by operation of law or otherwise, by either party hereto without the prior written consent of the other party shall be void, except an assignment to a successor to substantially all of the assets and business of the assigning party in accordance with the provisions of Article X hereof which shall not require such consent provided, however, that nothing herein shall be deemed to relieve the party hereto making such assignment from the obligation to give notice thereof in accordance with Article XI hereto.

E. Each of the parties agrees to indemnify and hold the other harmless from all liabilities arising from any claim for brokerage commissions or finder's fees in connection with the transactions contemplated by this Agreement and based upon any alleged arrangements or agreements made by or on behalf of the indemnifying party.

F. The representations, warranties, covenants and agreements of the parties contained in this Agreement shall not be discharged or dissolved upon, but shall survive, the Closing on the Closing Date, and shall be unaffected by any investigation made by any party at any time.

G. The invalidity of any particular provision of this Agreement will not affect the other provisions thereof, but this Agreement will be construed to all effects as if such provisions had been omitted.

H. The construction, interpretation and enforceability of this Agreement shall be governed by the laws of England.

I. Except as contained in the Exhibits hereto, the terms and conditions herein contained constitute the entire agreement between the parties with respect to the subject matter hereof and supersede all previous communications either oral or written between such parties with respect to such subject matter, and no agreement or understanding varying or extending any right or obligation hereunder of either party shall be binding unless in a writing signed by a duly authorised officer or representative of the party against which such variance or extension is sought to be enforced.

J. This Agreement may be executed in one or more counterparts and each of such counterparts shall for all purposes be deemed to be an

original but all such counterparts shall together constitute but one and the same instrument.

K. The provisions of this Agreement shall continue for so long as each party hereto continues to hold 50% of the outstanding stock of JVE and JVA. Upon either party hereto ceasing to hold 50% of the stock of JVE or JVA the provisions of this Agreement except for Article XII hereof shall terminate forthwith. The provisions of Article XII shall continue in full force and effect for two (2) years after termination of the other provisions of this Agreement. Nothing herein shall be deemed to permit either party hereto to transfer any shares of JVA or JVE in violation of Article X hereof.

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed as of the day and year first above written.

Signed by James Sellar Hutchison
for and on behalf of
The British Oxygen
Company Limited

Chairman

425

Signed by Richard V. Giordano
for and on behalf of
Air Reduction
Company, Incorporated

Richard V. Giordano

Group Vice President

CX-12-2-10

EXHIBIT A

THE PRODUCT LINE

The Product Line shall consist of :

Air Separation Plants

Methane/natural gas liquefaction, refrigeration and purification plants

Carbon-monoxide and hydrogen purification/separation plants

Gas liquefiers
Argon and helium separation and purification equipment
Rare gas separation and purification equipment

Other low temperature process plants

Gaseous and liquid product storage equipment for installation at tonnage and liquid plant sites other than factory manufactured vacuum insulated tanks

Engineering and contracting services relating to the installation of transmission pipelines installed in connection with process plants

Dissolved acetylene plants

Nitrous oxide plants

Hydrogen/nitrogen plants (HNX)

Products and processes which are deemed from time to time to fit in with the scope of the business and as agreed by the Board

Factory manufactured tankage above 500 U.S. gallon capacity for cryogenic liquid storage and transportation ("Tankage Items")

A 3786

CX-12-Z-11

EXHIBIT B

(i) Names of directors and senior management of JVE

As "A" Directors

Dr Nicol Gross
Mr Leslie Edward George Smith
Mr Peter Laister

As "B" Directors

Mr Colin Alan Bettridge Leslie
Mr Guy William Beck
Mr Ronald Charles Hill

Secretary

Mr John Charles Taylor

Acting Secretary for witnessing, sealing of and signing of documents vice secretary

Mr Ronald Charles Hill

(ii) Name of each person holding a power of attorney from JVE

Mr Francis William Berthold Kittel - for Patent & Trade Mark matters

(iii) JVE has no banking account or safe deposit box.

A 3787

CX-12-2-12

EXHIBIT C

1. Names of Directors of JVE :

Donald Reich

Henry M. Koster

Joseph M. Walsh, Jr.

Donald T. Spengeman

Donald B. Bussewitz

Arthur N. Field

Peter P. Nitze

2. Names of Officers of JVA :

President	-	Donald Reich
Executive Vice-President		Donald T. Spengeman
Secretary	-	Joseph M. Walsh, Jr.
Treasurer	-	Donald B. Bussewitz

3. JVA has no outstanding Powers of Attorney, no bank accounts and no safe deposit box.

A 3788

CX-12-2-13

EXHIBIT D

Description of Edmonton site and plant.

Land (Registered at H.M. Land Registry with title absolute under Title Nos. MX 362841 and NGL 450) comprising 20.5 acres with buildings covering an area of 500,000 square feet approximately and plant required to service the buildings (central heating systems, boilers, lifts, gantries etc.) and other landlord's fixtures, (electric lighting system, office partitioning, etc.) being the property referred to in a valuation by Messrs Cluttons of 5 September 1967 addressed to BOC.

A3789 CX-12-2-14

EXHIBIT E

THIS INDENTURE, made the day of September , nineteen hundred and sixty-seven

BETWEEN AIR REDUCTION COMPANY, INCORPORATED,

a corporation duly organized and existing under and by virtue of the laws of the State of New York having its principal office in the 150 East 42nd Street, County of New York and State of New York, the grantor, and

WITNESSETH, that the grantor, in consideration of the grantee ,

One Dollar ($1.00) ----------

lawful money of the United States, and other good and valuable consideration receipt whereof is hereby acknowledged, has hereby give, grant, bargain, sell, alien, release, enfeoff, convey and confirm unto the grantee and the heirs, successors and assigns of the grantee , forever

ALL that certain tract or parcel of land and premises, hereinafter particularly described, situate, lying and being in the Borough of New Providence in the County of Union and State of New Jersey.

BEGINNING at a point in the Northerly side line of Mountain Avenue herein distant Westerly 617.22 feet from its intersection with the old Westerly sideline of South Street, if said sidelines were extended to form an intersection and from said point of Beginning running thence (1) Along the said Northerly side line of Mountain Avenue westerly on a curve to the right having a radius of 970.00 feet for a distance of 70.75 feet, thence (2) still along said sideline South 84 degrees 18 minutes 15 seconds West 49.30 feet; thence (3) still along said sideline, Westerly on a curve to the left, having a radius of 2030.00 feet for a distance of 361.80 feet to lands now or formerly of Walter Toms, thence (4) along said lands North 13 degrees 57 minutes West 37.79 feet; thence (5) still along said lands, North 4 degrees 15 minutes East 58.80 feet; thence (6) still along said lands North 87 degrees 49 minutes West 1.64 feet; thence (7) still along said lands North 12 degrees 43 minutes seconds West 160.39 feet; thence (8) still along said lands and along lands now or formerly of Milton Wald, South 77 degrees 18 minutes 20 seconds West 100.11 feet to lands now or formerly of Air Reduction Company, thence (9) along said lands, North 38 degrees 45 minutes East 79.34 feet; thence (10) still along said lands North 52 degrees 15 minutes East 280.00 feet to lands now or formerly of Allstate Insurance Company, thence (11) along said lands South 37 degrees 45 minutes East 338.50 feet to the point or place of BEGINNING.

SUBJECT TO:

1. Any unpaid taxes.
2. Restrictive covenants recorded in Book 356 page 12 and Book 376 page 280.
3. Utility grant to Jersey Central Power & Light Company and New Jersey Bell Telephone Company in Book 2204 page 320 and Book 2422 page 270.
4. Rights of water company in 12 inch water main and 6 inch water main as shown on survey by Aurrhammer Associates, Inc. E & S dated February 2, 1967.

Being the same premises conveyed to Air Reduction Company, Incorporated by Union Oil Company of California by deed dated February 27, 1967 recorded March 10, 1967 in Book 2795 page 3.

BEST COPY AVAILABLE

TOGETHER with the appurtenances and all the estate and rights of the grantor in and to said premises.

TO HAVE AND TO HOLD the premises herein granted unto the grantee of the grantee forever

A 3790

CX-12-2-15

E.1

AIR REDUCTION COMPANY, INCORPORATED (hereinafter referred to as "Airco") hereby assigns all its right, title and interest in and to the within agreement between it and De Cristopher Construction Company of Bound Brook, New Jersey, dated (hereinafter referred to as the "Agreement") to (hereinafter referred to as "Assignee"). The Assignee hereby accepts such assignment and assumes the performance of all of the terms, covenants and conditions of the Agreement on the part of Airco to be performed and agrees to pay all amounts due thereunder. The Assignee hereby agrees that it will well and truly indemnify and save harmless Airco from all manner of suit, action, damages, charges and expenses; including attorney and counsel fees that Airco may sustain by reason of the Assignee's breach of any of the terms, covenants and conditions of the said Agreement.

IN WITNESS WHEREOF, the parties hereto have duly executed this Agreement on the day of , 1967.

AIR REDUCTION COMPANY, INCORPORATED

Attest:

By_____

_____

Attest:

By_____

_____

[Add Acknowledgements]

A 3791

CX-12-2-16

E.2

KNOW ALL MEN BY THESE PRESENTS, that AIR REDUCTION COMPANY, INCORPORATED, a New York corporation, having its principal office at 150 East 42nd Street, in the County of New York, State of New York hereinafter called the Seller, for and in consideration of the sum of One Dollar ($1.00) lawful money of the United States, to the Seller, in hand paid, at or before the ensealing and delivery of these presents, by AIRCO-BOC Cryogenic Plants Corporation hereinafter called the Buyer, the receipt whereof is hereby acknowledged has bargained and sold, and by these presents does grant and convey, unto the said Buyer, its successors and assigns, the goods and chattels particularly described and mentioned in the Schedules hereto annexed and made part hereof, all thereof being now situated within premises lying in the Borough of New Providence, in the County of Union and State of New Jersey conveyed by deed of even date herewith by the Seller to the Buyer. The Schedules annexed hereto are comprised of 10 pages (Fixed Assets) and 18 pages (Non Capital Furniture and Office Equipment)each of which pages has been initialled by the signers.

TO HAVE AND TO HOLD the same, unto the said Buyer its successors and assigns, forever AND Seller does covenant and agree, to and with the said Buyer to warrant and defend the sale of said goods and chattels hereby sold unto the said Buyer, its successors and assigns, against all and every person and persons whomsoever.

IN WITNESS WHEREOF, the Seller has caused these presents to be signed by its proper corporate officers and caused its proper corporate seal to be hereunto affixed the day of September in the year one thousand nine hundred and sixty-seven.

AIR REDUCTION COMPANY, INCORPORATED

ATTEST:

_____ By_____

A 3792

CX-12-2-17

E.3

STATE OF NEW JERSEY)
: ss:
COUNTY OF)

BE IT REMEMBERED, That on this day of September, in the year One Thousand Nine Hundred and Sixty-Seven before me, the subscriber, a personally appeared who, being by me, duly sworn on his oath, doth depose and make proof to my satisfaction, that he is the of Air Reduction Company, Incorporated, the Seller named in the within instrument; that is the President of said corporation; that the execution, as well as the making of this Instrument, has been duly authorized by a proper resolution of the board of directors of said corporation; that deponent well knows the corporate seal of said corporation; and the seal affixed to said Instrument is such corporate seal and was thereto affixed and said Instrument signed and delivered by said President, as and for his voluntary act and deed and as for the voluntary act and deed of said corporation, in presence of deponent, who thereupon subscribed his name thereto as witness.

Sworn to and subscribed before me,

at

the date aforesaid.

A 3793

CX-12-2-18

Sept. 11, 1967
Page 1

A.I.G. - MURRAY HILL

FIXED ASSETS

No.	Item	Serial/ Lock No.	Manufacturer	Value
C01	Secretary Desk	DWA-104	Shaw Walker	$ 125
C02	" "	DWA-127	"	125
C03	" "	DWA-106	"	125
004	" "	DWA-131	"	125
005	IBM Selectric	4870731	IBM	400
006	" "	43-94242	IBM	400
007	Electric Typewriter	1963594	IBM	375
008	" "	B-13-7713765	Royal	375
009	5-drawer file legal w/lock	-	Steelcase	110
010	" " "	-	"	110
011	5-drawer file legal wo/lock	-	"	110
012	Desk - G.O.	FR-74	"	125
013	Reference Table	-	"	80
014	Desk - G.O.	FR-85	"	140
015	Reference Table	-	"	80
016	Secretary Desk	FR-58	"	150
017	" "	FR-1	"	150
018	Electric Typewriter	2517701	IBM	375
019	Manual Typewriter	9355844	Underwood	150
020	Transcriber	358956	IBM	400
021	Dictator	618304	IBM	400
022	Desk - G.O.	FR-47	Steelcase	125
023	Reference Table	-	"	80
		TOTAL -		$4,635

A.I.G. - MURRAY HILL

FIXED ASSETS

No.	Item	Serial/ Lock No.	Manufacturer	Value $
024	Desk - G.O.	FR-324	Steelcase	125
025	"	FR-40	"	100
026	Reference Table	-	"	70
027	Desk - G.O.	FR-74	"	100
028	Reference Table	-	"	65
029	Desk - G.O.	FR-26	"	100
030	Reference Table	-	"	70
031	Desk - G.O.	FR-74	"	115
032	Reference Table	-	"	70
033	Desk - G.O.	FR-111	"	125
034	Reference Table	-	"	70
035	5-drawer file ltr. w/lock	-	Desks, Inc.	80
036	Desk - G.O.	FR-34	Steelcase	110
037	Reference Table	-	"	70
038	Desk - G.O.	FR-43	"	110
039	Reference Table	-	"	70
040	Desk - G.O.	FR-345	"	135
041	Reference Table	-	"	80
042	Desk - G.O.	FR-115	"	110
043	Reference Table	-	"	65
044	Desk - G.O.	FR-73	"	110
045	Reference Table	-	"	70
046	5-drawer file legal wo/lock	-	"	60
		TOTAL -		$2,080

A 3795

CX-12-Z-20

Sept. 11, 1967
Page 3

A.I.G. - MURRAY HILL

FIXED ASSETS

No.	Item	Serial/ Lock No.	Manufacturer	Value $
047	Desk - G.O.	FR-52	Steelcase	110
048	"	FR-105	"	100
049	"	FR-49	"	100
050	"	FR-76	"	100
051	"	FR-22	"	100
052	Reference Table	-	"	70
053	Friden Calculator	341743	Friden	400
054	Desk - G.O.	FR-104	Steelcase	100
055	"	FR-77	"	100
056	"	FR-80	"	100
057	"	FR-48	"	100
058	"	FR-36	"	100
059	"	FR-74	"	110
060	"	FR-102	"	100
061	Calculator	560486	Marchant	25
062	Desk - G.O.	FR-372	Steelcase	150
063	"	FR-18	"	110
064	Reference Table	-	"	75
065	Adding Machine	621	Victor	100
066	Desk - G.O.	FR-99	Steelcase	75
067	"	FR-31	"	50
068	Secretary Desk	251	Y & E	75
069	Calculator	765866	Olivetti	500
		TOTAL -		$2,850

A.I.C. - MURRAY HILL

FIXED ASSETS

No.	Item	Serial/ Lock No.	Manufacturer	Value $
070	Typewriter - Manual	6648153	Royal	125
071	5-drawer file ltr. wo/lock	-	Desks, Inc.	50
072	" " "	-	Steelcase	60
073	" " "	-	Desks, Inc.	50
074	Desk - G.O.	FR-35	Steelcase	100
075	"	FR-112	"	100
076	"	FR-13	"	100
077	"	FR-82	"	110
078	Reference Table - 60"	-	Y & E	30
079	Friden Electronic Calculator	6877	Friden	1,800
080	5-drawer file ltr. wo/lock	-	Desks, Inc.	35
081	Desk - G.O.	FR-53	Steelcase	110
082	"	FR-339	"	130
083	Reference Table	-	Y & E	40
084	Desk - G.O.	251	Y & E	65
085	"	251	Y & E	65
086	"	251	Y & E	65
087	"	FR-31	Steelcase	75
088	Reference Table	-	"	70
089	5-drawer file ltr. wo/lock	-	"	60
090	Desk - G.O.	FR-100	"	100
091	"	FR-9	"	75
092	Calculator	598814	Marchant	350
		TOTAL -		$3,765

A.I.G. - MURRAY HILL

FIXED ASSETS

No.	Item	Serial/ Lock No.	Manufacturer	Value $
093	Desk - G.O.	FR-53	Steelcase	100
094	Reference Table	-	"	60
095	Dictator	905401	Stenocord	150
096	5-drawer file ltr. wo/lock	-	Steelcase	40
097	Desk - G.O.	FR-54	"	75
098	Reference Table	-	"	70
099	Desk - G.O.	FR-82	"	80
100	Friden Calculator	915614	Friden	600
101	Adding Machine	B267181	Burroughs	30
102	Reference Table	-	Steelcase	60
103	Desk - G.O.	FR-66	"	80
104	"	FR-25	"	110
105	Reference Table	-	"	70
106	Desk - G.O.	FR-87	"	65
107	Reference Table	-	"	60
108	Desk - G.O.	FR-79	"	100
109	5-drawer file ltr. wo/lock	-	Desks, Inc.	40
110	Desk - G.O.	FR-75	Steelcase	100
111	Reference Table	-	"	60
112	5-drawer file ltr. w/lock	-	Rem. Rand	40
113	Desk - G.O.	FR-54	Steelcase	150
114	"	FR-316	"	110
115	"	FR-53	"	100
			TOTAL -	$2,350

A.I.C. - MURRAY HILL

FIXED ASSETS

No.	Item	Serial/ Lock No.	Manufacturer	Value $
116	Desk - G.O.	FR-61	Steelcase	100
117	"	FR-74	"	100
118	"	FR-75	"	150
119	"	FR-106	"	100
120	"	FR-12	"	125
121	"	FR-335	"	110
122	"	[illegible]	"	110
123	"	FR-18	"	150
124	"	FR-34	"	110
125	Reference Table	-	"	60
126	Transcriber	905421	Stenocord	150
127	Selectric Typewriter	4870751	IBM	400
128	Manual Typewriter	8477204	Underwood	100
129	Selectric Typewriter	4846548	IBM	400
130	Print Machine - Dry Copy	6982	Commodore	200
131	Desk - G.O.	FR-78	Steelcase	110
132	"	FR-114	"	110
133	"	FR-30	"	110
134	"	FR-18	"	110
135	"	12094	Art Metal	100
136	Electric Typewriter	1894545	IBM	375
137	5-drawer file ltr. wo/lock	-	Steelcase	60
138	Desk - G.O.	FR-73	"	100
		TOTAL -		$3,440

A.I.C. - MURRAY HILL

FIXED ASSETS

No.	Item	Serial/ Lock No.	Manufacturer	Value $
139	Reference Table	-	Steelcase	80
140	5-drawer file ltr. wo/lock	-	Rem. Rand	50
141	Desk - G.O.	FR-51	Steelcase	110
142	"	FR-340	"	110
143	"	FR-86	"	100
144	"	FR-70	"	100
145	"	FR-92	"	100
146	5-drawer file ltr. wo/lock	-	Rem. Rand	50
147	Reference Table	-	Steelcase	100
148	Secretary Desk	FR-19	"	75
149	" " 45"	FR-131	"	80
150	" " 45"	FR-86	"	40
151	Manual Typewriter	KMM3478565	Royal	20
152	" "	8773884	Underwood	100
153	Mimeo Machine	9A0392	Gestetner	350
154	Electric Collator	9609	GBC	150
155	Electric Hole Punch	002598	GBC	500
156	Bruning Copyflex	35510	Bruning	1,000
157	Postage Machine	5604028	Pitney Bowes	1,000
158	Postage Scale	32460	"	225
159	Manual Typewriter	HHE135809208	Royal	50
160	Manual Typewriter	13-8384446	Underwood	60
161	Binding Machine	63218	GBC	100
		TOTAL -		$4,550

A.I.G. - MURRAY HILL

FIXED ASSETS

	Item	Serial/ Lock No.	Manufacturer	Value $
2	Desk - G.O.	251	Y & E	50
3	"	251	Y & E	50
4	"	1211	Globe Wernicke	20
5	Reference Table	-	Steelcase	45
6	Desk - G.O.	251	Y & E	20
7	5-drawer file legal wo/lock	-	Steelcase	40
8	5-drawer file ltr. wo/lock	-	Art Metal	40
9	" " "	-	"	40
70	" " "	-	Steelcase	35
71	" " "	-	Desks, Inc.	15
72	" " "	-	Art Metal	40
73	" " "	-	Rem. Rand	20
74	5-drawer file legal wo/lock	-	"	40
75	" " "	-	"	40
176	" " "	-	"	40
177	" " "	-	"	40
178	" " "	-	"	40
179	" " "	-	"	40
180	" " "	-	"	35
181	5-drawer file legal w/lock	-	Steelcase	60
182	5-drawer file ltr. wo/lock	-	Rem. Rand	20
183	5-drawer file legal wo/lock	-	"	20
184	" " "	-	"	20
			TOTAL -	$ 810

A.I.C. - MURRAY HILL

FIXED ASSETS

No.	Item	Serial/ Lock No.	Manufacturer	Value $
185	5-drawer file legal wo/lock	-	Rem. Rand	20
186	" " "	-	"	20
187	5-drawer file leg. w/lock broken	-		20
188	5-drawer file legal wo/lock	-		20
189	Drafting Table	-	Hamilton	125
190	Desk	-	Y & E	20
191	Typewriter - Manual	8655323	Underwood	140
192	5-drawer paper file	Flat	Stacor	100
193	" "	-	Rem. Rand	40
194	Desk - G.O.	235	-	30
195	"	M-2009	Art Metal	50
196	"	-	Y & E	20
197	5-drawer file legal w/lock	-	Rem. Rand	20
198	Wood Draft. Table 60 x 38	-	Hamilton	75
199	" " "	-	"	75
200	" " "	-	"	75
201	" " "	-	"	75
202	" " "	-	"	75
203	" " "	-	"	75
204	" " "	-	"	75
205	Metal Drafting Table	-	"	120
206	" "	-	"	120
207	" "	-	"	120
		TOTAL -		$1,510

A.I.C. - MURRAY HILL

FIXED ASSETS

No.	Item	Serial/ Lock No.	Manufacturer	Value $
208	Metal Drafting Table	-	Hamilton	120
209	" "	-	"	120
210	" "	-	"	120
211	" "	-	"	120
212	" "	-	"	120
213	Drawing Tub	-	"	200
214	"	-	"	150
215	"	-	"	200
216	"	-	"	150
217	"	-	"	200
218	"	-	"	150
219	"	-	"	200
220	"	-	"	200
221	Drawing File	-	Art Metal	60
222	"	-	"	60
223	"	-	"	60
224	"	-	"	60
225	"	-	"	75
226	"	-	"	60
227	15-drawer flat drawing file	-		225
228	Manual Typewriter 20"	8342631	Underwood	75
		TOTAL -		$2,725

A 38803

CX-12-2-28

Sept. 11, 1967
Page 1

AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
001	Secretary's chair	$ 25.00
002	" "	25.00
003	" "	25.00
004	" "	25.00
005	Side chair w/o arms	20.00
006	" " " "	20.00
007	" " " "	20.00
008	" " " "	20.00
009	File cabinet - 4 drawers	60.00
010	" " " "	60.00
011	" " " "	60.00
012	Swivel chair w/arms	50.00
013	Side chair w/arms	30.00
014	" " "	30.00
015	" " "	30.00
016	" " "	30.00
017	2 drawer file	45.00
018	Bookcase 52" x 37"	50.00
019	Side chair w/arms	30.00
020	" " "	30.00
	TOTAL -	$685.00

A 3804

CX-12-2-29

AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
021	Side chair w/arms	$ 30.00
022	" " "	30.00
023	Swivel chair w/arms	50.00
024	Telephone stand	40.00
025	2 drawer file cabinet	45.00
026	" " " "	45.00
027	Secretary's chair	45.00
028	" "	45.00
029	Swivel chair w/arms	50.00
030	Side chair w/arms	30.00
031	" " "	30.00
032	" " "	30.00
033	" " "	30.00
034	2 drawer file w/legs	45.00
035	Telephone stand	40.00
036	Bookcase 42" x 37"	45.00
037	Side chair w/arms	30.00
038	" " "	30.00
039	" " "	20.00
040	" " "	30.00
	TOTAL -	$740.00

AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
041	Swivel chair w/arms	$ 40.00
042	Telephone stand	30.00
043	2 drawer file w/l	40.00
044	Bookcase 48" x 35"	50.00
045	4 drawer file w/l	70.00
046	" " " "	70.00
047	50" ref. table	55.00
048	Side chair w/arms	30.00
049	" " "	30.00
050	4 drawer file	30.00
051	2 drawer file w/l	40.00
052	Bookcase - 4 shelf 50" x 37"	45.00
053	Side chair w/arms	30.00
054	Swivel chair w/arms	45.00
055	Side chair w/arms	30.00
056	" " "	30.00
057	" " "	30.00
058	Swivel chair w/arms	35.00
059	2 drawer file w/l	45.00
060	Telephone stand	35.00
	TOTAL -	$810.00

A 3806 CX-12-2-31

AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
061	2 shelf bookcase 42" x 37"	$ 40.00
062	Side chair w/arms	30.00
063	" " "	30.00
064	" " "	30.00
065	Swivel chair w/arms	30.00
066	Bookcase - 2 shelf 42" x 37"	40.00
067	2 drawer file cabinet w/l	30.00
068	Side chair w/arms	30.00
069	" " "	30.00
070	Swivel chair w/arms	20.00
071	2 drawer file cabinet w/o l	40.00
072	Cipher 1 tape recorder	55.00
073	Bookcase - 2 shelf	20.00
074	Side chair w/arms	30.00
075	" " "	30.00
076	Swivel chair w/arms	50.00
077	Bookcase	25.00
078	"	25.00
079	2 drawer file w/o l	10.00
080	Side chair w/arms	30.00
	TOTAL -	$625.00

A 3807

CX-12-2-32

AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
081	Side chair w/arms	$ 30.00
082	Swivel chair w/arms	35.00
083	Bookcase - 1 shelf	20.00
084	" " "	20.00
085	4 drawer letter file	35.00
086	Side chair w/arms	30.00
087	" " "	30.00
088	Swivel chair w/arms	50.00
089	Bookcase - 2 shelves	40.00
090	2 drawer file w/1	30.00
091	Side chair w/arms	30.00
092	" " "	30.00
093	Swivel chair w/arms	50.00
094	2 drawer file - legal - w/o 1	30.00
095	2 drawer file w/1	30.00
096	Bookcase - 42" x 37"	40.00
097	Side chair w/arms	30.00
098	" " "	30.00
099	" " "	30.00
100	Swivel chair w/arms	50.00
	TOTAL -	$670.00

CX-12-2-33

AIC - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
101	2 drawer file w/l	$ 25.00
102	4 drawer file w/l.	20.00
103	5 drawer letter file	20.00
104	" " " "	30.00
105	Bookcase - 3 shelf 50" x 36"	30.00
106	Side chair w/arms	30.00
107	" " "	30.00
108	" " "	30.00
109	" " "	30.00
110	" " "	30.00
111	" " "	30.00
112	" " "	30.00
113	" " "	30.00
114	" " "	30.00
115	" " "	30.00
116	" " "	30.00
117	" " "	30.00
118	" " "	30.00
119	" " "	30.00
	TOTAL -	$545.00

CX-12-2-34

AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
120	Side chair w/arms	$ 30.00
121	" " "	30.00
122	" " "	30.00
123	" " "	30.00
124	" " "	30.00
125	" " "	30.00
126	" " "	30.00
127	" " "	30.00
128	" " "	30.00
129	" " "	30.00
130	" " "	30.00
131	" " "	30.00
132	" " "	30.00
133	" " "	30.00
134	" " "	30.00
135	" " "	30.00
137	Side chair w/o arms	20.00
137	" " " "	20.00
138	" " " "	20.00
139	" " " "	20.00
	TOTAL -	$560.00

A 3810

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Page 8

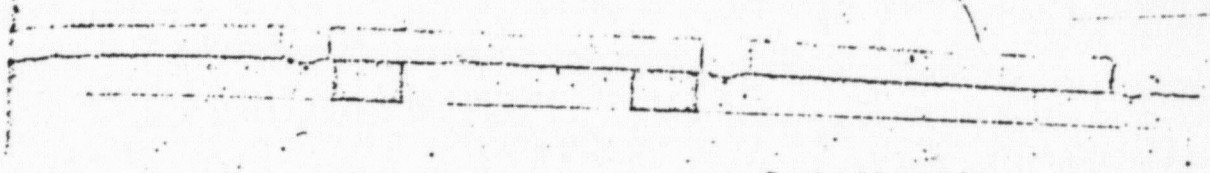
AIG - MURRAY HILL

Non-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
140	Side chair w/o arms	$ 20.00
141	" " " "	20.00
142	" " " "	20.00
143	" " " "	20.00
144	" " " "	20.00
145	" " " "	20.00
146	" " " "	20.00
147	" " " "	20.00
148	" " " "	20.00
149	" " " "	20.00
150	" " " "	20.00
151	" " " "	20.00
152	" " " "	20.00
153	" " " "	20.00
154	" " " "	20.00
155	Swivel chair w/arms	35.00
156	" " "	35.00
157	" " "	35.00
158	" " "	25.00
159	" " "	25.00
160	" " "	25.00
	TOTAL -	$480.00

A 3811

CX-12-2-36



AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
161	Swivel chair w/arms	$ 40.00
162	" " "	30.00
163	" " "	20.00
164	" " "	20.00
165	" " "	40.00
166	" " "	35.00
167	" " "	20.00
168	" " "	50.00
169	" " "	40.00
170	" " "	40.00
171	" " "	15.00
172	" " "	40.00
173	" " "	30.00
174	" " "	30.00
175	" " "	40.00
176	" " "	30.00
177	" " "	40.00
178	" " "	25.00
179	" " "	25.00
180	" " "	45.00
181	" " "	20.00
	TOTAL -	$675.00

A 3812

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AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
182	Swivel chair w/arms	$ 20.00
183	" " "	20.00
184	" " "	20.00
185	" " "	30.00
186	" " "	25.00
187	" " "	30.00
188	" " "	40.00
189	" " "	35.00
190	" " "	20.00
191	" " "	45.00
192	" " "	20.00
193	" " "	25.00
194	" " "	25.00
195	" " "	40.00
196	" " "	20.00
197	" " "	45.00
198	" " "	20.00
199	" " "	20.00
200	" " "	45.00
201	" " "	35.00
202	" " "	35.00
203	" " "	20.00
	TOTAL -	$635.00

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AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
204	Swivel Chair w/arms	$ 35.00
205	" " "	20.00
206	" " "	20.00
207	" " "	20.00
208	" " "	30.00
209	" " "	30.00
210	" " "	20.00
211	" " "	25.00
212	" " "	25.00
213	" " "	35.00
214	" " "	35.00
215	" " "	20.00
216	" " "	20.00
217	" " "	30.00
218	" " "	20.00
219	Secretary's swivel chair	20.00
220	" " "	15.00
221	" " "	20.00
222	" " "	20.00
223	" " "	20.00
224	" " "	15.00
225	" " "	20.00
	TOTAL -	$515.00

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AID - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
226	Secretary's swivel chair	$ 20.00
227	" " "	20.00
228	Drafting stools	20.00
229	Side chair w/o arms	20.00
230	" " " "	20.00
231	4 drawer file cabinet - letter	20.00
232	2 drawer file cabinet w/lock	30.00
233	4 drawer file cabinet w/lock	25.00
234	" " " " "	25.00
235	" " " " wo/lock	40.00
236	" " " " "	25.00
237	" " " " "	40.00
238	" " " " "	20.00
239	" " " " "	20.00
240	" " " " "	40.00
241	" " " " "	30.00
242	" " " " "	30.00
243	" " " " "	30.00
244	2 " " " "	20.00
245	" " " " w/lock	30.00
246	3 " " " "	30.00
247	2 " " " wo/lock	20.00
	TOTAL -	$575.00

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AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
248	4 drawer file cabinet wo/lock	$ 20.00
249	" " " " w/lock	20.00
250	2 " " " "	25.00
251	" " " " "	25.00
252	" " " " wo/lock	20.00
253	" " " " "	20.00
254	" " " " "	20.00
255	" " " " w/lock	35.00
256	" " " " "	30.00
257	4 " " " wo/lock	25.00
258	" " " " "	20.00
259	Bookcase - 2 shelves - 36" x 42"	20.00
260	" 3 "	40.00
261	" " "	40.00
262	" 2 "	20.00
263	" "	20.00
264	" " "	20.00
265	" " "	20.00
266	" " "	20.00
267	" 3 "	20.00
268	" " "	30.00
269	" " "	30.00
	TOTAL -	$540.00

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AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
270	Bookcase - 3 shelves - 36" x 42"	$ 30.00
271	" " "	30.00
272	" " "	30.00
273	" " "	30.00
274	" " "	30.00
275	" " "	15.00
276	" " "	30.00
277	" " "	30.00
278	" " "	25.00
279	" " "	15.00
280	" " "	15.00
281	" " "	15.00
282	" " "	20.00
283	" " "	15.00
284	" " "	15.00
285	" " "	20.00
286	" 2 "	15.00
287	" 3 "	20.00
288	" " "	20.00
289	" " "	20.00
290	" " "	20.00
291	" " "	20.00
	TOTAL -	$480.00

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AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
292	Bookcase - 2 shelves - 36" x 42"	$ 25.00
293	" 3 "	15.00
294	" " "	10.00
295	" " "	10.00
296	" " "	10.00
297	" " "	10.00
298	" " "	10.00
299	" " "	10.00
300	" " "	15.00
301	" 1 "	10.00
302	" " "	10.00
303	50" Ref. table	50.00
304	" " "	50.00
305	" " "	50.00
306	" " "	50.00
307	Stick files	25.00
308	50" Ref. table	50.00
309	" " "	50.00
310	" " "	50.00
311	Telephone stand	30.00
312	" "	30.00
313	Sentry safe	85.00
	TOTAL -	$655.00

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AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
314	50" Ref. table	$ 50.00
315	" " "	50.00
316	" " "	50.00
317	Stick file	25.00
318	50" Ref. table	50.00
319	Stick file	25.00
320	50" Ref. Table	55.00
321	" " "	50.00
322	" " "	50.00
323	" " "	50.00
324	" " "	50.00
325	" " "	50.00
326	" " "	50.00
327	" " "	50.00
328	" " "	55.00
329	" " "	50.00
330	" " "	50.00
331	" " "	50.00
332	" " "	50.00
333	Stick file	25.00
334	" "	25.00
335	" "	25.00
336	" "	25.00
	TOTAL -	$1,010.00

AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
337	Stick file	$ 25.00
338	Telephone stand	30.00
339	4 drawer file cabinet	20.00
340	7 drawer file cabinet	20.00
341	4 " " "	20.00
342	Side chair wo/arms	20.00
343	Drafting chair	20.00
344	" "	5.00
345	" "	20.00
346	" "	20.00
347	" "	20.00
348	" "	20.00
349	" "	20.00
350	" "	20.00
351	" "	20.00
352	" "	20.00
353	" "	20.00
354	" "	20.00
355	" "	20.00
356	" "	20.00
357	" "	20.00
358	" "	20.00
	TOTAL -	$440.00

CX-12-2-45

AIG - MURRAY HILL

NON-CAPITAL FURNITURE AND OFFICE EQUIPMENT

No.	Item	Value
359	Drafting chair	$ 20.00
360	" "	5.00
361	" "	20.00
362	" "	20.00
363	" "	20.00
364	Drill press	75.00
365	Grinder	25.00
	TOTAL -	$185.00

A 3821

CX-12-2-46

Exhibit F

AGREEMENT

THIS AGREEMENT made as of the_____ day of _____, 1967, between AIR REDUCTION COMPANY, INCORPORATED, a New York corporation hereinafter called "AIRCO" and BOC-AIRCO Plant Limited the name of which is to be changed to BOC-AIRCO Cryogenic Plant Limited hereinafter called (JV England) an English corporation

W I T N E S S E T H :

WHEREAS AIRCO possesses certain technical information and know-how useful in the design, manufacture, and use of the products and components of the products listed and described in Appendix A ("the Product Line"), said technical information and know-how being that information and know-how in AIRCO's possession as of the date of this Agreement and referred to hereinafter as "AIRCO KNOW-HOW", and

WHEREAS certain of the AIRCO KNOW-HOW is of a confidential nature, and

WHEREAS AIRCO is the owner of certain patents and patent applications relating to the Product Line, all of said patents and applications for patents being listed in Appendix B; said patents and applications and the patents issued on said applications being referred to hereinafter as the "PATENT RIGHTS," and

WHEREAS (JV England) desires to obtain the AIRCO KNOW-HOW and a license with respect to the PATENT RIGHTS and the AIRCO KNOW-HOW, as hereinafter provided

NOW, THEREFORE, in consideration of the premises and of the mutual undertakings hereinafter set forth the parties hereto agree as follows:

1. AIRCO hereby grants to JVE a non-exclusive, non-transferable right and license throughout the world (subject to the provisions of Section 7 hereof) to employ the inventions covered by the PATENT RIGHTS and the AIRCO KNOW-HOW in the manufacture, use, and sale of the Product Line.

2. At the request of (JV England) and at such times and in such form as is mutually agreed by the parties hereto, AIRCO shall disclose to (JV England) the AIRCO KNOW-HOW. AIRCO's obligation under this paragraph 2 shall not extend to any information or data the disclosure or transmittal of which is subject to Governmental Regulation or prior approval by a Government agency unless and until such regulation has been complied with or such approval obtained or to any information or data as to which it is under a duty of confidentiality to others or which it is otherwise legally bound not to disclose or which it has acquired under such circumstances that its disclosure would amount to bad faith or to a breach of good business ethics.

3. Until September 30, 1975, (JV England) shall use its best efforts to hold in confidence the AIRCO KNOW-HOW disclosed to it. The foregoing commitment shall not, however, at any time extend to any part of the AIRCO KNOW-HOW disclosed to (JV England) which

(i) was known to (JV England) prior to the receipt thereof by (JV England) from AIRCO, or

(ii) was known to the public or generally available to the public prior to the receipt thereof by (JV England) from AIRCO, or

(iii) becomes known to the public or generally available to the public subsequent to the receipt thereof by (JV England) from AIRCO through no act or failure to act on the part of (JV England), or

(iv) corresponds in substance to information disclosed or made available to (JV England) at any time by a third party having a bona fide right to disclose or make available the same to (JV England).

4. The granting of licenses and the disclosure of AIRCO KNOW-HOW to (JV England) as provided herein shall be without any representation, warranty, or guarantee of any kind on the part of AIRCO except that AIRCO represents that it owns the PATENT RIGHTS as aforesaid. AIRCO does not represent or warrant that the subject matter of the ~~licenses~~ patent rights or of the AIRCO KNOW-HOW may be used without infringing the rights, including patent rights, of third parties and AIRCO shall not be liable to (JV England) for losses, debts, damages, liabilities or expenses arising out of lawsuits brought by third parties whose rights, including patent rights, shall or may have been so infringed.

5. As royalties for the license under the PATENT RIGHTS granted by AIRCO to (JV England), and for the use of AIRCO KNOW-HOW disclosed by AIRCO to (JV England) JVE shall pay to AIRCO 2 1/2% of JVE's annual net profit on sales of the Product Line for each fiscal year of JVE, or portion thereof, until September 30, 1975. "Net Profit" as used herein shall mean JVE's net profit before income tax and before deduction for the royalty payable pursuant hereto.

6. Within sixty (60) days after the close of each fiscal year of JVE during the term of this Agreement, (JV England) shall pay to AIRCO the royalties arising hereunder with respect to such fiscal year. All payments hereunder shall be made to AIRCO through a prime bank in the United States without discount, in United States Dollars converted at the official rate of exchange between the United States Dollar and the English Pound prevailing on the date of remittance.

7. JVE will not use or export any of the AIRCO KNOW-HOW disclosed to it hereunder or any product manufactured by use of such AIRCO KNOW-HOW or any product manufactured by use of or embodying the inventions covered by the PATENT RIGHTS if such would violate the provisions of the Export Control Regulations of the United States Department of Commerce or the Foreign Assets Control or Foreign Transactions Control Regulations of the U. S. Treasury Department or any similar law or regulation of the United States as from time to time in effect.

8. The term of this Agreement shall begin as of the date hereof, and unless this Agreement be sooner terminated as provided in Paragraph 8 hereof, shall terminate September 30, 1975; provided, however, that thereafter JVE shall continue to enjoy the licenses granted in Section 1 hereof in perpetuity.

9. In the event that (JV England) should fail to perform any of its obligations hereunder, AIRCO may terminate this Agreement by giving sixty (60) days prior notice in writing to (JV England) provided, however, that if (JV England) shall make good its default within sixty (60) days after the date of its receipt of any such notice, this Agreement shall remain in full force and effect. Promptly after any such termination, (JV England) shall pay to AIRCO all unpaid royalties accruing hereunder up to and including the date of termination. Any waiver by AIRCO of a right accruing as a result of a breach by (JV England) of any of the provisions of this Agreement shall not be considered as a continuing waiver of other breaches of the same or other provisions of this Agreement.

10. All notices and other communications given or sent by either party to the other hereunder, if intended for AIRCO should be addressed to AIR REDUCTION COMPANY INCORPORATED, 150 East 42nd Street, New York, New York and if intended for (JV England) should be addressed to BOC-AIRCO Plant Limited, Hammersmith House, London W.6. or to such other address as either party may notify the other of in writing.

11. This agreement shall inure to the benefit of and be binding upon AIRCO, its successors and assigns and shall inure to the benefit of and to be binding upon (JV England), but shall not be assignable by (JV England) without the prior written consent of AIRCO.

IN WITNESS hereunder the parties hereto have executed this Agreement as of the day and year first above written.

AIR REDUCTION COMPANY, INCOPPORATED

A 3829

CX-12-2-54

APPENDIX A

THE PRODUCT LINE

The Product Line shall consist of :

Air Separation Plants

Methane/natural gas liquefaction, refrigeration and purification plants

Carbon-monoxide and hydrogen purification/separation plants

Gas liquefiers
Argon and helium separation and purification equipment
Rare gas separation and purification equipment

Other low temperature process plants

Gaseous and liquid product storage equipment for installation at tonnage and liquid plant sites other than factory manufactured vacuum insulated tanks

Engineering and contracting services relating to the installation of transmission pipelines installed in connection with process plants

Dissolved acetylene plants

Nitrous oxide plants

Hydrogen/nitrogen plants (HNX)

Products and processes which are deemed from time to time to fit in with the scope of the business and as agreed by the Board

Factory manufactured tankage above 500 U.S. gallon capacity for cryogenic liquid storage and transportation ("Tankage Items")

CX-12-2-55

A 3830

AIRCO

APPENDIX B

SCHEDULE OF PATENTS AND APPLICATIONS

CONSTITUTING THE PATENT RIGHTS

The patents and applications identified in this Schedule are included in the Patent Rights only to the extent the inventions relate to the field of this agreement.

The Patent Rights includes any applications for letters patent hereafter filed by Airco and corresponding to any of the patents and applications identified in this Schedule.

CX-12-2-56

A 3831

Appendix B

THE PRODUCT LINE
1 AIR SEPARATION PLANTS

U.S. Patent No.	Title	Inventor
2,685,181	Separation of the Constituents of Gaseous Mixtures	Schlitt
2,708,831	Separation of Air	Wilkinson
Canada 586,172		
2,762,208	Separation of the Constituents of Air	Dennis
Canada 579,809 " 600,466 " 600,467 " 600,468		
2,964,913	Separation of Air	Smith
Canada 610,995		
2,982,107	Separation of the Elements of Air	Smith
Canada 626,905 Britain 848,297		
3,108,867	Separation of the Elements of Air	Dennis
Canada 667,025		
3,123,457	Separation of Air into Nitrogen Oxygen, Argon, etc.	Smith
Canada 683,956 Britain 939,409		
3,127,260	Separation of Air into Nitrogen Oxygen and Argon	Smith
Canada 669,975		
3,264,830	Separation of the Elements of Air	Smith
3,273,379	Method of Locating Leaks	Rendes Banks
Britain 26703/66 (Appl) Canada 962414 (Appl)		
3,274,789	Process for Removing Congealed Impurities from a Gas Expander	Mitchell
Canada 953,996 (Appl)		
3,316,725	Refrigerating and Conditioning of a Process Stream in a Cryogenic Process	Dennis
Appl. S.N. 371,917	Production of Ultrahigh Purity Oxygen	Blanchard Smith
Canada 931,607 (Appl) France 19142 (Appl) Britain 22105/65 (Appl)		

1 AIR SEPARATION PLANTS Cont'd.

U.S. Patent No.	Title	Inventor
Appl.S.N.388,515 Canada 937,244 (Appl)	Control of Degree of Superheat in Expansion Engine Exhaust	Angerhofer
Appl.S.N.480,073 Britain 35457/65 (Appl) Canada 956287 (Appl)	Sampling Line for Cryogenic Liquid Mixture	Burch
Appl.S.N.494,177 Canada 970,197 (Appl) Britain 44923 (Appl) France 79243 (Appl) Germany 53080 (Appl) Japan 65239 (Appl)	Process of Liquefaction	Smith Ferrell
Appl.S.N. 561,833	Method and Apparatus for Providing Insulation	Beninati Duron Perry
Appl.S.N. 577,346 Canada 992,312 (Appl)	Air Separation Using Dephlegmator	Smith
Appln.S.N. 577,421 Canada 992,313 (Appl) Germany 56197 (Appl) France 115945 (Appl) Japan 46364 (Appl) Britain 39448/67 (Appl)	Production of Oxygen-Enriched Air	Smith

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Appendix No. 15
B

A 3833

THE PRODUCT LINE

2 METHANE LIQUEFACTION PLANTS

Patent No.	Title	Inventor

NONE

Appendix Exh B
B

A3834

CX-12-2-59

THE PRODUCT LINE

3 CARBON-MONOXIDE PURIFICATION PLANTS

Patent No.	Title	Inventor

NONE

CX-12-2-60

A 3835

Appendix B

THE PRODUCT LINE

A GAS LIQUEFIERS

Patent No.	Title	Inventor
U.S. 2,685,180	Casifying an Extraneous Liquefied Gas and Simultaneoulsy Liquefying Another Gas	Schlitt
U.S. 3,298,732 Canada 652,752	Liquefaction and Purification of Low Temperature Gases	Dennis
U.S. 3,187,514	Immersion Freezing System	Rendos
U.S. 442,917 (Appl.) UK 13315/66 (Appl.)	Means and Method for Recuperating Refrigeration	Blanchard and Smith

CX-12-2-61

A 3836

B

THE PRODUCT LINE -

5 ARGON PURIFICATION EQUIPMENT

Patent No.	Title	Inventor
U.S. 2,530,602	Recovery of the Constituents of Gaseous Mixtures	Dennis
U.S. 2,640,870	Method of and Apparatus for Analyzing Gases	Seitz
U.S. 2,874,030 UK 743,821 Canada 582,757	Argon Purification	Dennis
U.S. 3,062,016 Canada 626,914	Maintaining High Purity Argon Atmosphere	Dennis and Smith
U.S. 534,209 (Appl)	Ambient Temperature Oxygen Removal	Schmidt

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B

THE PRODUCT LINE

6 RARE GAS PURIFICATION EQUIPMENT

Patent No.	Title	Inventor
U.S. 2,962,868 Canada 599,916	Method of Concentrating Krypton-Xenón	Dennis
U.S. 3,061,403 Canada 622,457	Method of Purifying Monatomic Inert Gases	Rendos
U.S. 3,191,393 Canada 635,341	Krypton-Xenon Separation From a Gas Mixture	Dennis
U.S. 3,240,554	Method of Removing Oxygen From Relatively Inert Crude Gases	Angerhofer
U.S. 3,306,711	Apparatus for the Purification of Gases	Angerhofer

Appendix B

THE PRODUCT LINE

7 OTHER LOW TEMPERATURE PROCESS PLANTS

Patent No.	Title	Inventor
U.S. 2,585,288	Recovery of Carbon Dioxide	Van Nuys
U.S. 2,738,658	Separation of Gas by Solidification	Bronson

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A 3833

Appendix XIII B

THIN PRODUCT LINE

8 GASEOUS & LIQUID PRODUCT STORAGE EQUIPMENT FOR INSTALLATION AT PLANT SITES

Patent No.	Title	Inventor
U.S. 2,682,154	Storage of Liquefied Gases	Wilkinson
U.S. 2,911,331 Canada 610,927	Degreasing Process	Dennis and Rendos
U.S. 3,091,096 Canada 657,677	Delivering Vapors of Low Boiling Liquids	Rendos and Smith
U.S 3,135,099	Vaporizing Station for Liquefied Gas	Holm
U.S. 3,273,349	Variable Demand Air Rectification Plant with Recycle	Litvin and Muska
U.S. 3,306,061 Canada 966,016 (Appl.)	Blowdown of Cryogenic Liquid Supply Vessel	Scott and Kleinhaut
U.S. 3,319,434 Canada 932,276 (Appl.) UK 11404/67 (Appl.) France 98553 (Appl.) Germany 55,141 (Appl.) Belgium 42,389 (Appl.) Japan 14502/67 (Appl.) Italy 15205 (Appl.) Sweden 5145/67 (Appl.) S. Africa 67/2065 (Appl.) Australia 20275/67 (Appl.) India 110,629 (Appl.) Mexico 95891 (Appl.) Brazil 189,577 (Appl.)	Low Temperature Refrigeration and Gas Storage	Matesanz
U.S. 455,780 (Appl.)	Provision for Peak Loads in a Gaseous Oxygen Plant	Phillips

CA-12-2-65

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Appendix B

THE PRODUCT LINE

9 LARGE CRYOGENIC TANKAGE (OVER 500-GALLON CAPACITY) FOR USE AS STATIONARY OR MOBILE CRYOGENIC STORAGE OR TRANSPORTATION

Patent No.	Title	Inventor
U.S. 2,726,575 Canada 628,404	Suspension for Double-Walled Containers	Scherr
U.S. 2,761,397 Canada 536,995	Trailer	Holst
U.S. 2,858,136 Canada 567,842	Transport Container for Liquefied Gases	Rind
U.S. 3,185,334	Opacified Powdered Insulation	Omilian, Jr.
U.S. 3,237,647	Heat Insulation	Jordan
U.S. 3,241,705 Canada 906,521 (Appl.)	Container	Love and Wolpert
U.S. 631,550 (Appl.) UK 21285/67 (Appl.) Australia 21560/67 (Appl.) Belgium 43552 (Appl.) India 100,595 (Appl.) S. Africa 67/2712 (Appl.) Canada 990,493 (Appl.) Austria 4401/67 (Appl.) France 156,270 (Appl.) Germany 55,657 (Appl.) Holland 67.06842 (Appl.) Italy 15830/67 (Appl.) Switzerland 6662/67 (Appl.) Sweden 6709/67 (Appl.) Japan 30436/67 (Appl.)	Liquid Helium Distribution System	Kleinhaut, Lee and Paag
U.S. 504,720 (Appl.) Canada 971,545 (Appl.) UK 49283/66 (Appl.)	The Prevention of Thermal Oscillation in Cryogenic Fluid	Perry

CX-12-2-66

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Appendix A-7 B
B

THE PRODUCT LINE

10 DISSOLVED ACETYLENE PLANTS

Patent No.	Title	Inventor
U.S. 2,031,755 Canada 549,870	Acetylene Generator	Hooper
U.S. 358,919 (Appl.)	Method and Apparatus for Generating Acetylene	Foster

CX-12-2-67

A 3842

Appendix B
B

THE PRODUCT LINE
11 NITROUS OXIDE PLANTS

Patent No.	Title	Inventor
U.S. 2,609,273	Nitrous Oxide Production	Balcar

A 3845

CX-12-2-68

BOC

Appendix 13

THE PRODUCT LINE
1 AIR SEPARATION PLANTS

Chart No.	Short Title	Patent No.
A.134	Double gauze random packing	UK 776,942
A.171	Liquid Methane-air separation	UK 804,944 Belgium 559,891 France 1,196,821 India 61,354 Pakistan 108,407 S. Africa 2448/57 USA 3,058,314
A.185	Evaporative power generation	UK 808,535 Australia 220,879 Canada 594,795 France 1,182,614 India 61,657 USA 2,964,917
A.246	Eliminating pressure surging	UK 862,758 Canada 633,611 India 69,140 USA 2,983,107
A.277	Precooling of gas mixtures	UK 897,812 Australia 249,855 Canada 814,183 France 1,288,072 India 74,754 S. Africa 10/61
A.278	LO storage and revaporisation	UK 890,458 Australia 249,630 Canada 626,645 France 1,275,951 Germany B.60,462 India 74,417 S. Africa 4943/60 USA 3,058,315
A.283	Tonnox I.C. Mark II	UK 929,798 France 1,289,009 S. Africa 1395/61 Australia 251,183 India 76,097 Canada 639,764 USA 100,607 Germany 1,159,971

1 AIR SEPARATION PLANTS Contd.

Ref. No.	Short Title	Patent No.
A.288	Fractionating Unit II	UK 919,867 S. Africa 220/61 India 77,179 Australia 246,017 Canada 826,065
A.291	Modified Heylandt Cycle	UK 917,695 Canada 883,873 USA 145,560
A.314	Compact condenser - evaporator	UK 936,873 Australia 251,338
A.319	Self balancing regenerators	UK 950,700
A.326	Enriched air cycles I	UK 974,639 S. Africa 1858/63 France 1,357,406 USA 3,298,184 Italy 696,907 Germany B.72,057 India 88,094 Canada 857,814 Australia 31154/63
A.336	Condenser evaporator unit (Enriched air)	UK 986,169 Australia 38012/63 India 93,084
A.346	Separation of air (P of A to A.283)	UK 985,068 India 92,412 Australia 41360/64 Canada 716,787
A.352/358	Tonnox I.C. Mark III	UK 998,751 Australia 47130/64 India 94,212 S. Africa 3243/64
A.360	Tray for distillation column	UK 1,035,372 Australia 59531/65
A.364	Gas purification	UK 1,004,741 India 92,534

(X-12-2-70)

2 AIR SEPARATION PLANTS Contd.

Case No.	Short Title	Patent No.
A.373	Sieve tray with expanded metal overlay	UK 10862/65 (Appl) S. Africa 851/66 USA 533,493 France 1,471,111 Italy 763,314 India 104,062 Germany B.86,174 Holland 2860/66 Japan 15609/66 Australia 2767/66 Sweden 344/66 Canada 954,575
A.378	Condenser evaporator - 'Tunable' tubes	UK 10863/65 (Appl) USA 530,307 France 1,470,838 Germany B.86,175 Australia 2570/66
A.396	Air separation/liquefaction attachment	UK 48252/65 (Appl) India 107,730 Australia 13366/66
A.405	Elevated Pressure LP Cycle Leuna Cycle	UK 24522/66 (Appl) USA 637,271 Germany B.92,502 (West) France 108,585 Italy 16647/67 Pakistan 513/67 Australia 23304/67 Canada 991,742 E. Germany AP 176/124,965
A.411	LO-acetylene determination in presence of ozone	UK 53086/66 (Appl)
A.422	Air Separation - Kosice Cycle	UK 3354/67 (Appl)

THE PRODUCT LINE
2 METHANE LIQUEFACTION PLANTS

Case No.	Short Title	Patent No.
A.350	Methane Extraction	UK 936,242 Australia 41654/64 India 92,616

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Appendix KB

THE PRODUCT LINE
3 CARBON-MONOXIDE PURIFICATION PLANTS

Case No.	Short Title	Patent No.

NONE

CAS PRODUCT LINE
4 CAS REQUESTERS

No.	Chart Title	Patent No.

NONE

A 3849

CX-12-2-74

Appendix XB

THE [illegible]
5 ARGON PURIFICATION [illegible]

[illegible] No.	Short Title	Patent No.
A.125	Argon purification. Plant H.	UK 723,050 Australia 165,232 Canada 529,368 France 1,080,594 Holland 49,552 S. Africa 17765
A.128	Argon - recycle control of purifiers	UK 744,373 Australia 162,179 Canada 531,386 S. Africa 19660 USA 2,826,480
A.129	Argon purification (Airco)	UK 743,821
A.130	Argon purification at atmospheric temperature using Hersch Meters (Licence to Engelhart Ind.)	UK 757,037 Australia 202,545 Belgium 534,729 Canada 540,856 France 1,117,002 Germany 1,021,829 Holland 90,685 India 53,450 Italy 526,196 N. Zealand 113,252 S. Africa 475/55 Sweden 172,244
A.160	Argon purification by molecular sieves-2	UK 809,168 Australia 221,814 Canada 611,417 India 61,572 USA 2,895,512
A.374	Argon - solid/liquid storage	UK 44467/65 (Appl) Australia 12354/66

Appendix XB

B ... No.	... Matter	Patent No.
A.260	Recovery of Helium	UK 836,043
A.268	Krypton/Xenon Separation	UK 927,518 Canada 659,288 USA 3,063,217
A.359	Helium purification I	UK 1,038,535 France 1,428,367 Australia 55996/65 Germany B.80,907 India 99,029 USA 438,616
A.361	Purification of Helium II	UK 1,029,327 India 98,530 Australia 56492/65
A.388	Helium purification III	UK 36366/65 (Appl) S. Africa 4251/66 USA 567,937 France 1,469,678 Germany B.88,580 India 105,768 Australia 8924/66

Appendix 15

THE LINDE AIRCO
CYCLES AND PURIFICATION PROCESS PATENTS

No.	Patent No.
A.212 Liquid methane - liquid H_2	UK 892,601 Australia 251,981 France 1,217,272 Holland 108,342 USA 2,983,585
A.322 Hydrogen purification	UK 954,848 India 83,042 Australia 271,074
A.333 Hydrogen purification by N_2 washing	UK 1,013,422 Australia 40212/64 India 91,928
A.339 Molecular sieve	UK 1,001,294 S. Africa 5822/63 France 1,378,708 Italy 712,571 Germany B.74,760 India 91,503 Australia 39394/64
A.413 Hydrogen - adsorption purification	UK 19254/67 (Appl)

[illegible]

[illegible] No.	Short Title	Patent No.
A.137	Vacuum insulation of pipelines	UK 788,353 Australia 211,367 Canada 561,271 India 55,608 S. Africa 517+/55 N. Zealand 115,102
A.400	LT articles of cement-bonded glass fibres	UK 6151/65 (Appl) India 109,177

A 3853

Appendix 1B

9 [illegible]

Data No.	Short Title	Patent No.
A.225	Self-compensating insulation	UK 833,623 USA 2,916,179
A.254	Insulating powders	UK 892,477 Canada 611,585
A.272	Tube-plate vaporisers I	UK 858,090 Australia 249,933 Canada 623,825 India 74,012
A.295	Anti-stratification II	UK 9[illegible]39 Canada 648,977 USA 3,103,791
A.351	Oxygen storage & transport unit	UK 1,016,555 Germany 1,223,432 Belgium 654,199 France 1,410,648 Switzerland 433,793 Italy 738,768 Holland 11606/64 Australia 50099/64
A.372	Twin extruded tube exchanger	UK 35595/64 (Appl) India 101,300

CX-12-Z-79

Appendix XB

DATA PRODUCT LINES
IC DESIGNED ADAPTABLE PLANTS

Pr. No.	Short Title	Patent No.

NONE

A 3855

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Appendix A

FILE PRODUCT LINE
22 SEISMIC SHELLS PLANTS

Case No.	Short Title	Patent No.

NONE

Cx-14-A

Report on Visit

GARDNER CRYOGENICS CORPORATION
2136 City Line Road
Bethlehem, Pennsylvania, U.S.A.

Date: September 24, 1968

By: J. A. Perham
A. Muller

Interviewed: William A. Gardner, President
A. John Gardner, Manager Cryogenic & Industrial Gas Products

We had learned through the press that The Carpenter Steel Company of Reading, Penn., were acquiring Gardner Cryogenics Corporation. Last week we learned the deal had fallen through. Al Muller arranged an interview via John Gardner with Bill Gardner, President.

We asked Bill Gardner for details of the Carpenter offer and he provided us with a Carpenter quarterly report dated March 31, 1968 - copy enclosed. Gardner Cryogenics would have received 100,000 convertible preferred shares in Carpenter - callable in 5 years at $120 per share - paying dividends of $200,000 in years one to three and $450,000 thereafter. The 100,000 preferred shares could be converted to 300,000 common if held beyond three years. The deal was worth $12,000,000.

Bill Gardner personally owns about 2/3 of Gardner Cryogenics. He would have continued to manage the business as a division of Carpenter and would have been the single largest shareholder. He knows the management of Carpenter well - they are compatible - furthermore, the top executive are getting on in years.

Bill Gardner is 38 years old. He has a B.S. degree in Chemical Engineering from Lehigh University. He is married three years and has one child. Formerly he worked for Air Products in Allentown adjacent to Bethlehem, Penn., on liquid hydrogen research. He left them and founded his business in 1961 because he had an idea for a helium refrigerator and liquefier. This led him to seek a source of helium and resulted in a 50/50 partnership in Alamo Chemical Company with Phillips Petroleum Company.

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Report on Visit to Gardner Cryogenics Corporation

He said the deal with Carpenter did not fail on price. In the Carpenter Report they refer to a new company, Titanium Technology Corporation, to be owned jointly by Carpenter and Electronic Specialty Company. This deal is not yet consummated. In the meantime a much larger company, International Controls, has gained control of Electronic Specialty. According to Bill Gardner, if this venture goes through it is evident that International Controls will be the surviving company. Instead of being a major shareholder of Carpenter and managing an important division of Carpenter, he would be submerged in the International Controls empire. Further, while he knows the Carpenter executive and their ages, International Controls is quite a different matter. He was only willing to sell 100% of his company if he saw a future for himself in which he could be of value and influence. While he would benefit very substantially financially, at his age he does not want to retire and vegetate no matter how much money is involved. He claims he terminated the proceedings with Carpenter.

The authorized equity of the company is 500,000 common shares, of which 400,000 are issued. Bill Gardner owns two thirds, and about 4% are available for employee stock options.

Present sales will be just under $10-million this year. About 95% of these sales are in the USA and 15% are sales to the US government agencies. He said the capital employed is about $5-million and they have bank borrows at 1/2% over prime rate (currently 6 1/2 + 1/2 = 7%) of $3-million. They had a loss last year over $1-million, caused by lengthy start-up difficulties at the Alamo Chemical plant and the need to buy helium at higher prices from the US Bureau of Mines to meet commitments. Profit this year is expected to be $200,000. There is a $1-million loss carry forward for tax purposes. The company auditors are Haskins & Sells. The company has as yet no pension plan and no union other than Teamsters on their trucks. They have experienced no labour problems. There is no litigation pending other than a minor employment contract with a former employee in Belgium. They have no licenses or agreements from or to anyone. There are no patents - believing because of their size that secrecy is the best protection.

The Alamo Chemical plant has a capacity of 140-million cubic feet per year of pure helium. Phillips Petroleum plan to build another plant with a capacity of 300-million s.c.f. per year of helium which will all be available to Gardner Cryogenics. The cost of this new plant is said to be $15-million. Gardner claims he was offered a half interest, but that

it was just too much for his company to undertake. Instead, he feels his product deal with Phillips is better. The Alamo Chemical plant strips helium from natural gas. Other heavy hydrocarbons are also stripped and sold to Phillips. The " cleaned" natural gas is sold or returned to a natural gas distribution company. Any surplus helium above Gardner Cryogenic requirements is sold to the US government under the helium conservation plan. Bill Gardner claims, as a result, that his company has the cheapest production cost for helium in the USA.

To date, sales have been primarily helium and we believe them to be number two in the USA market in both liquid and gaseous helium. They also are developing a substantial export market and appear to be well advanced in liquid transportation overseas. They are now starting cryogenic hardware sales, e.g. refrigerators, superconducting magnets, helium dewars and research vessels, helium trailers and low-temperature systems. They are also offering low-temperature process equipment. Copies of their brochures are enclosed.

Personally, Bill Gardner left a very fine impression at this first meeting. He appears sincere, enthusiastic, hard-working, and his performance to date indicates imagination, intelligence and courage. In our opinion he is Gardner Cryogenics and his abilities must be included in any acquisition.

Bill Gardner showed a sincere interest and willingness to take these discussions further. He suggested the week of October 28th in London as he will be in Europe at that time. Obviously, this business as an acquisition cannot be evaluated on past earnings. It can be judged on the technical competence he has put together. However, its real value lies in its future and what BOC could do with the business - assuming Bill Gardner could see a real future for himself in the venture.

In discussing the future, Bill Gardner indicated that he expected his present business to grow substantially in the period immediately ahead. He mentioned a figure of $50-million as a sales goal by 1975 without being specific as to the breakdown of these sales for his principal product lines, i.e. helium, process equipment and deep low-temperature devices such as super-conducting magnets. When questioned as to the amount of additional capital which would have to be invested in order to achieve the sales goal indicated above, he said he would prefer to take this matter under advisement and would be prepared to quote a figure and schedule for this capital at a later time.

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Report on Visit to Gardner Cryogenics Corporation

In considering the general matter of the future of this business and the integration of this business into the total BOC picture, it becomes obvious that if steps were taken to add additional outside capability to the Gardner operation and simultaneously to make use of certain advanced technology already available in BOC in the Cryoproducts, Edwards High Vacuum and Murex groups, an additional growth can be anticipated using the Gardner business as the basic vehicle for obtaining this additional growth. On a conservative basis, an additional $15-million of sales could be expected beyond the projection provided by Gardner.

In order to accomplish this objective in a minimum of time, it is suggested that consideration be given to the acquisition of the following organizations, each of whom has already given indication that they would be willing to discuss potential acquisition/joint venture with BOC. These organizations are:

1.	Cryomagnetics	- this organization is presently engaged in the manufacture of super-conducting materials for use in super-conducting magnets.
2.	Cryenco	- this organization is one of the original US companies engaged in the development, design, production and sale of a line of products similar to that of BOC's Cryoproducts group.
3.	Energy Beams Incorporated	- this is a small organization that possesses the technological capability to provide electron beam devices for melting, vacuum pumping, recording, etc., for use inside vacuum systems - this organization already has relations with Edwards High Vacuum.

These companies, each bringing a high order of technical capability into the spectrum of activities presently encompassed by Gardner, would provide a broadened base for growth in the US market with the expectation that the advanced technology so commercialized would be available for overseas

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Report on Visit to Gardner Cryogenics Corporation

markets at an appropriate time. The metallurgical, cryogenic and vacuum technology within the BOC groups would provide additional reinforcement for the development of the US market, provided the R & D programs in the BOC organizations could be suitably adjusted to reflect the requirements of the US market rather than be limited to the UK and other overseas markets as is the case today.

When the total capability of a consolidated unit embracing Gardner and the organizations listed above is coupled with the already existing capabilities in the BOC groups, it is quite probable that the strength of such a combination would be sufficient to compete with any other organization of this type in the US.

At this point in time, no attempt has been made to analyse how best to structure a group effort of the type proposed. This will be possible only after a suitable study of objectives and their relationship to personnel, facilities and capital is made. The intent here is to simply indicate that, by combining additional capability with that already present in Gardner, it should be possible to create a business of significant size in the US which will be concerned with high technology products and services. This capability can then be used overseas at such time as requirements for these products and services appear in other market areas.

JAP/P
AM/P

October 1, 1968

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1 Introduction

2 Objective

3 The Business of GCC

4 The Helium Scene :
- a) Demand
- b) Availability
- c) Economic Outlook
- d) BOC Competitive Position

5 Cryoproducts & Superconductivity

6 The GCC Possibility

7 Conclusions

8 Recommendations

APPENDICES

I - Page 1 - BOC 'Cryoproducts' Sales

Page 2 - Functional analysis of the US Cryogenic hardware market 1967-1972.

Page 3 - Estimated slice of market open to producer of cryoproduct type goods USA 1972.

II - Superconductivity - Brief Appraisal (draft)

III - GCC - Preliminary Financial Assessment

IV - GCC - Five Year Forecast

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GARDNER CRYOGENICS CORPORATION

1 Introduction

GCC was founded in 1961 by William A. Gardner, a former Air Products Inc. employee, to exploit ideas he had for helium refrigerators and liquefiers.

Very soon his need for a source of helium developed into a 50/50 partnership with Alamo Chemical Company, a wholly owned subsidiary of Phillips Petroleum Company

Recently negotiations with Carpenter Steel Company, Reading, Pennsylvania, who were to acquire the Gardner Cryogenic Corporation, were broken off. On learning that GCC might, therefore, once more be available, Mr J.A. Perham, President of Canox and Dr A. Muller, had conversations with GCC regarding possible BOC interest and reported (letter 24.9.68).

A meeting at Hammersmith House on 5.11.68. with Mr W.A. Gardner discussed the Gardner Cryogenic Corporation and its future. Forward estimates of sales and profits were provided by Mr W.A. Gardner.

2 Objective

This paper attempts to set down the case for and against a major BOC investment in GCC by which it would acquire the great majority of its equity whilst continuing to be a partner with Alamo Chemical Company and retaining Mr W.A. Gardner in his present position - a pre-requisite of his contract with Phillips Petroleum Company.

The analysis of the five year forecast in relation to possible purchase price (the Carpenter Steel Company offer being $ 12 million) is separately reported by Finance Division.

3 The Business of GCC

Essentially is two distinct parts:-

a) Helium purification from crude containing 1,5% He, liquefaction and distribution on both wholesale and retail basis.
Present capacity is 140 million cu ft per year, all of which is sold, whilst new capacity of 300 million cu ft per year is being installed by Alamo Chemical - the product being made available to GCC. This part of the business is strictly on a 50/50 partnership basis which means that whilst Phillips hold no GCC equity, they provide half the capital and receive half the profits. It is believed that future arrangements will maintain a profit split on a pro-rata basis to the asset ownership.
At present He accounts for 90% of the GCC total business and 95% is accounted for by sales in the US, i.e., about $9 million.

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b) Cryoproducts type hardware is designed and manufactured at their 30,000 sq. ft new facilities at Bethlehem, Penn. They claim to be expert in superconductivity magnet systems and that they are the only company with complete 'in-house' capabilities for the production of standard and custom designed magnet systems including dewars of all types, monitoring apparatus, handling equipment and the helium required for testing and operating superconducting magnet systems. They give customers full access to inspect their methods and procedures and to investigate their capabilities in cryogenic and superconductivity expertise. Currently 60 people are engaged on R & D and engineering.
GCC designed and manufactured the 5ft dia x 15.5 ft deep dewar for the world's largest superconducting magnet at Avco-Everett Research Laboratory and recently won the order, valued at £80,000, to supply a large superconducting magnet to the West German Research Centre at Julich for MHD research. BOC quoted for this order.

The present cryoproducts and superconducting business is said to be about $1.0 million but that this would be higher if GCC had not been manufacturing for their own use a variety of containers for their helium distribution business.

4 The Helium Scene

a) Demand

No World Market survey for helium has been carried out by BOC and so far as is known only the US Bureau of Mines have estimated the total US helium demand in the future. The 1959 logistic curve has been very closely followed up to 1967 with slight shortfall up to 1967 (907 million cu ft). If the curve is followed the demand will be:-

1970 - 1300 million cu ft
1975 - 1700 " " "
1980 - 1850 " " "

with an asymptotic state being reached after 1985 at about 2000 million cu ft., or approximately 100% increase in 13 years.

Federal sales, i.e. to NASA and other Federal agencies, dropped to 607 million cu ft in 1967 from 808 million cu ft in 1966 due to decreased activity in the US Space Program. In 1967, 300 million cu ft was produced and sold by the private helium industry. One source indicates possible further reduction in space requirements when solid fuel becomes the accepted propellant for space rockets and the need for systems purging are reduced.

In Europe, helium consumption was:-

1962	-	5 million cu ft	
1966	-	25 " " "	
1975	-	100 " " "	estimate based on application of US growth rate.

In Japan, helium consumption was:-

1966	-	10 million cu ft	
1975	-	? " " "	but expected to be very large!

b) Availability

i. North America

Apart from small quantities obtained from air separation plants, all the free world's helium is produced in USA and Canada. In the USA, Government exercises control through the Bureau of Mines Helium Conservation Program - which has producing plant of its own - as well as purchasing from private sector production.

Total helium production in the USA in 1967 was 4.8 billion cu ft. (c.f. 1980 possible demand 1.8 billion cu ft) of which 3.6 billion went to conservation. The private sector capacity adds about 650 million cu ft per year.

ii. Elsewhere

It is expected that very soon a small helium capacity of about 10 million cu ft p.a. will exist in France where Gaz de France will be extracting helium from Dutch natural gas going to Paris and which has to have about 14% N_2 removed.

The great unknown in the area is the potential 300 million cu ft from Algerian natural gas sources and further possibilities from Libya. Because this helium is a by-product in the process of liquefying natural gas, the operating costs should be lower than for plants in the USA and if it floods the European market, economic implications in the USA helium industry will be serious.

c) Economic Outlook

A.D. Little Inc in their paper delivered to American Compressed Gases Association said:-

"..... the helium gas price structure is approaching an unstable period. The price is set at $35 per 1000 cu ft and because of reducing deliveries, the Bureau of Mines Conservation Program is no longer self-supporting to the same extend it was in the past. One way to deal ....."

"Three things are clear; first, the author thinks the Bureau of Mines will tighten up their regulations on the use of government helium by

/....

insisting that all government agencies, contractors, and subcontractors use Bureau of Mines' gas. Remember, that for every 100 million cubic feet a year not sold by the Bureau of Mines, a loss of $2.4 million of net income results. Second, the Government laboratories are going to be motivated towards helium recovery systems if the price of helium is increased. And finally, the eventual self-sufficiency of the Europeans will worsen this dilemma, because American private industry will have to reduce its helium prices simply to compete with foreign sources. Also, there exists the possibility of foreign imports to the United States adding further pressures on the price of gas sold by North American private sources".

d BOC Competitive Position

In the UK, BOC estimates its total market share at 44%, Air Products 25% UKAEA 25% (supplied direct by Canadian Helium) Gardner Cryogenics 5% - balance others.

The total liquid helium market is estimated at 4.1 million cu ft of which approximately:-

UKAEA	45%
BOC	35%
AP	14%
Gardner	6%

It is believed that AP source of helium can be traced back to Gardner Cryogenics who supply a third party.

Recently AP acquired the issued share capital of Oxford Cryogenics Ltd "... one of the UK's leading distributors of liquid helium" and claiming to have 45% of the liquid helium market.

..... brings AP into the liquid helium market for the first time .....
..... and will also export it to Europe through its associate companies .....
..... and are confident that there is a future for helium in a much wider range of applications than at present.

5 Cryoproducts & Superconductivity

BOC Cryoproducts sales forecasts are shown in Appendix I with growth rates. These indicate approximately 25% - 30% growth rate which is quite good by many standards.

An attempt, in limited time, estimates the USA Cryoproduct market in 1973, from published information, at $93 million and the growth factors over 5 years resulting from a range of market share by 1973 for a business starting with $1.0 million in 1968.

6 The GCC Possibility

At this juncture BOC needs to consider whether it needs to take the GCC matter further - there are many gaps in knowledge, many questions to be asked on the financial side and deep probing of the realities of life of GCC with Phillips Petroleum. Clearly an unusual set-up has been created.

The five year forecasts based on the injection of a further $10 million by 1973 cannot be taken on their face value and the reasoning behind GCC projections need some proof.

Most especially, our information on the future for helium leads us to believe that halcyon days may be over in spite of what Mr W.A. Gardner had to say about the increasing value of helium and his plans for storage for the rainy day. However, if we accept the $48 million sales in 1973 and accept WAG's opinion that about half of this would be from hardware - two comments emerge that:-

a) the cryogenic hardware requirement at $24 million represents an estimated growth rate of over 100% and at 50%, $5 million by 1973 would represent an achievement of no mean order.

b) if the cryoproducts estimate is so far out, how can it be possible arbitrarily to increase the sales of helium?

Admittedly WAG comment may have been on the spur of the moment but it would surely have been wiser to have hedged the question if he did not really know the answer.

Three factors govern BOC interest in GCC:-

i Capacity available to BOC from Canadian Helium will be absorbed by 1970/71 and a new source(s) of supply will need to be established.

ii Cryoproducts improved performance as indicated by forward estimates can be exploited in USA given the right marketing and local production circumstances. An important gain would be the feedback of experience and technology to the UK for incorporation and exploitation in other spheres of influence.

iii BOC superconductivity expertise is believed to be good but injected into a USA opportunity could set our sights on great potential in this rapidly developing technology.

Appendix II is a brief appraisal, albeit in draft, of BOC position and needs in progressing superconductivity and contains an analysis of GCC from this standpoint.

Appendix III was prepared by Finance Division on receipt of J.A. Perham's letter dated 24.9.68 and poses many questions still unanswered after the discussions with W.A. Gardner.

What then are the opportunities that await BOC by the integration of GCC into the Group?

	PRO	CON
1)	Makes new source of He available to BOC Group.	Likely to be viewed by Airco as unfriendly act - consequences need to be considered. Possibly better to do 'most favoured nation' deal with Airco.
2)	BOC would benefit from marketing He in USA and gain experience of US practices. GCC clearly big in USA Helium business.	Competition likely to stiffen and gain on 'buy American' basis.
3)	Exposure to helium based technologies in USA will promote greater expertise in BOC Group.	
4)	BOC would - indirectly - become AP supplier, or cause supply difficulties by their having to set up new source. Existing contract may be binding.	Loss of AP outlet would affect revenue and profit.
5)	He source secure with Phillips Petroleum (although precise partnership agreements need to be checked)	Phillips reaction to BOC as partner unknown - no reason for it to be hostile; but danger of greater interest by them in BOC. *
6)	GCC lead in air shipment of liquid He of value to Overseas Companies He development and BOC move into European market.	No reason to suppose others will not catch up - and soon.
7)	Superconductivity expertise 'apparently good' as shown in brochures and demonstrated by orders taken for large systems.	Suspicion that expertise is based on 'borrowed' data and that proof of knowledge will come only after successful commissioning of new orders.
8)	Base for expansion in USA and all the benefits to be derived from involvement in the advanced state of USA R & D etc.	Danger that GCC reputation is not proven - possibly even tarnished. Repercussions almost inevitable from Airco.
9)	GCC projection of growth in sales of cryogenic hardware linked with BOC growing reputation and product range should enable joint progress in world market to be good.	Although brochures and WAG comments reassuring, many doubts cast on depth of knowledge and physical success with products. Apparent reluctance to let J.A. Perham see through the works unusual for American Company. Reaction from Airco probable on account of their having BOC license for turbines.

* Possible reaction from other oil companies resulting from our being partners with Phillips

7. Conclusion

To reach a decision that BOC should make a positive move to acquire GCC based on acceptance that all we have seen and heard is factual is hardly possible without confirmation on a number of points being received.

a) Five year forecast background needs to be revealed, especially the split between Helium and cryogenic hardware.

b) Fullest details of agreement with Phillips Petroleum need to be disclosed.

c) Depth of knowledge on superconductivity must be explored and evidence of proven success produced.

d) The actual state of their cryoproducts range, its acceptability and competitiveness need to be seen and BOC Cryoproducts Manager's comments essential.

e) BOC's determined policy on possible confrontation with Airco over helium competition in USA and cryoproducts in relation to Airco unwillingness to have in JV and their subsequent acquisition of license for BOC turbines.

It will be difficult always to avoid doing things in USA which will be certain not to upset Airco.

f) Detailed balance sheets and profit and loss accounts for past 5 years to be produced with breakdown to Finance Division requirements.

g) Many advantages possible from this form of entry to USA, especially from the links with existing BOC expertise and familiarities.

8 Recommendations

a) WAG should be told that BOC are interested in taking the matter a step further, subject to a number of reservations, which if he is as keen for BOC participation as he seemed, could readily be overcome:-

i Full disclosure of Phillips Agreement

ii BOC team (Finance, Superconductivity and Cryoproducts) to visit Bethlehem to carry out full appraisal of the main situations to enable JMD's to make recommendations on the value of BOC investment in the acquisition of GCC.

b) Serious alternative, so far as helium is concerned, would be to negotiate a 'most favoured nation' agreement with Airco for supplies of helium as the price for BOC disengaging from helium participation in the USA.

c) Full study of world helium future needs to be carried out urgently. If the future reveals serious probabilities of over capacity and/or much lower margins, BOC's best move may be to negotiate contracts for supplies rather than attempt to become involved directly.

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CR-15-I

BOC 'Cryoproducts' - Sales

	£'000	
1966	198 *	
1967	378 *	
1968	175	
1969	939	
1970	1,114	
1971	1,276	
1972	1,700 — 1580	Correction made 9/11/65
1973	2,060 — 1920	Correction made 9/11/65

* Excluding inter company sales.

Sales Growth rates

1966 - 73	39% P.A.
1967 - 73	33% P.A.
1967 - 72	35% P.A.
1968 - 72	58% P.A.
1969 - 73	20% P.A.
1970 - 73	25% P.A.

Functional analysis of the U.S. Cryogenic hardware market 1967-1972

	1967	1972	Growth %		Remarks
	mill $		5yr total	Rate	
Total hardware market	380	653	73	11.6	
of which ASU	223	355	47	8.0	
Refrigeration	42	134.6	221	26.2	Mostly in the food sector
Transport	34	53.3	58	9.6	" " " "
Test environment	22.8	26.3	15	2.8	Mostly in space, now bound to be less due to recent budget cut-back.
Other cryogen storage	38	80.9	112	16.2	Assumed to be static tanks for LN_2 LNG, LO etc. and smaller LN_2 filling stations.
Superconduction	na	15.2	-	-	Forecast must be least hard, growth could be a lot faster or slower.

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Source : Size and scope of cryogenic market by Market Research Division of Business Communications Inc.

1966

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ESTIMATED SLICE OF MARKET OPEN TO PRODUCER OF CRYOPRODUCT TYPE GOODS USA 1972

	$m Total	% slice open	$m Amount
ASU's	335	-	-
Refrigeration (LN_2 Food)	135	20	27.0
Transport	54	20	11.0
Test environment	26	10	2.6
Other cryogenic storage	81	30	24.3
Superconduction	15	100	15.0
Miscellaneous	12	-	-
Total	658	-	79.9
			Assume 1973 to be about 93.0

$ 24 mill	represents	26%	of	1973	market	which	corresponds	to	a	growth	of	over	100% pa.
$ 20	"	"	21.5	"	"	"	"	"	"	"	"	"	98% pa.
$ 15	"	"	16%	"	"	"	"	"	"	"	"	"	95% pa.
$ 10	"	"	10.8%	"	"	"	"	"	"	"	"	"	78% pa.
$ 5	"	"	5.4%	"	"	"	"	"	"	"	"	"	49.5% pa.

* on the basis of $ 1 mill in 1969.

Appendix 1 - Pg 3

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A 3872 APPENDIX II

Draft

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29.AU.65.

Papers as background for forthcoming discussions

I Superconductivity Review (mainly condensed verbatim from material supplied by Dr Goodman)

II BOC's Strategic Problem

III "GCC"

IV Superconductivity - Participating Firms (Supplied by Dr Goodman)

A 3873

Draft

I SUPERCONDUCTIVITY REVIEW

- Contents -

1 Definition of Business Area

2 The Concept

3 Markets

4 Prospects and Risks

5 BOC's Strengths and Weaknesses

6 Other Participants

7 BOC's Spending

1 Definition of Business Area

In the deep low temperature field it is possible to identify four principal areas of business activity :-

(a) Cryogenic hardware (cryostats, dewars, transfer lines, refrigerators, etc.)

(b) Applications based on liquid hydrogen technology.

(c) Self-contained superconducting systems

(d) Special electronic devices based on cryogenics.

This paper deals exclusively with item (c). Most of the enquiries for helium refrigerators are now for superconducting systems and so it is believed that area (c) could become bigger than (a) or (d) in due course. Area (d) would include such applications as masers (amplifiers used in tele-communications with satellites) and superconducting electronic devices (eg computer elements); in these fields BOC can and will offer certain parts, but not complete systems.

2 The Concept

The concept of a "Superconductivity Systems" market is based on the unique resistanceless properties of superconductors and on the fact that these properties can only be exploited rationally through the use of liquid helium technology.

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3 The Markets

a) Total

	Estimated total market, area 'c'(above) only	
	W.Europe (incl.UK) £ million pa	USA £ million pa
Total	.5	5.5 ($13 million)*
Including sales of superconducting material	.25	(?) *
Growth rate	About 20% pa	

(Market has grown from nil in 1962. One authority sees USA maintaining 20% pa up to 1975)

*Total USA spending on superconductivity, 1967, put by one authority at $20 million+, including $5 million for superconducting wire etc. At least 50% of the $20 million+ is spent by research laboratories.

Note also that UK market is probably somewhat less than the rest of Western Europe. Other markets probably not important at present; although Japan could expand rapidly soon. Communist bloc countries have difficulty in developing superconducting alloys and there could be appreciable sales if the present embargo were lifted. Considerable interest in superconductivity there; 400 people are working on applications of superconductivity in Moscow.

b Four Markets for Superconducting Systems can be Identified

(i) DC magnets for research

These include :-

Small laboratory-sized magnets (cost £100-£10,000) particularly for universities; W.European market for magnets alone: £100,000-£200,000 pa; US market probably $1-2 million.

Beam handling magnets for high energy physics laboratories (eg CERN), selling for £20,000-£40,000. W.European market at present held by conventional magnets: £2,000,000 pa. Contracts for two superconducting magnets have been placed in Europe in the last 2-3 years; BOC tendering shortly for £20,000 quadrupole for Rutherford.

Large magnets for miscellaneous research applications (selling for up to £100,000). About two required in Europe each year; further growth very probable.

A further possibility is that, through the development of new materials, superconductors may also be suitable for low frequency AC applications, notably the superconducting synchrotron. If the very real technical problems can be overcome there would occasionally be orders for magnets worth several million pounds, probably in the late 1970's.

In each case (except small laboratory magnets selling for up to £10,000) there would be a requirement for a helium refrigerator, selling price of the order of 50% of that of the magnet and cryostat.

NB BOC at present is exploiting only (i), not (ii) (iii) and (iv). However, BOC refrigerators will sometimes be found in support of (ii) and (iii).

(ii) DC Superconducting magnets for machinery

The first large scale commercial application of superconductivity. Motor is claimed to be lighter, cheaper and more economical than the conventional DC motor for powers in excess of 1,000 hp. The present UK market for DC motors with power in excess of 1,000 hp is about £5½ million pa. (There may also be a small market for superconducting AC machinery for certain aero-space applications)

(iii) Superconducting linear accelerators

A specialised research application requiring, in addition to BOC's expertise, ability in microwave engineering.

(iv) Power transmission

There is a possibility that cryogenic underground cables may one day supersede conventional underground cables in urban areas. Refrigeration requirements would be very large. However, numerous technical problems remain.

4 Prospects and Risks

A feature of the market for superconducting systems over the last few years has been the striking improvement in the characteristics of the material available. Cost per unit quantity of superconductor decreased by about 20% pa over the last 4 years. Also, owing to improved performance, the quantity required to perform a given task has decreased. There is every reason to believe that this trend will continue and therefore that superconducting magnets will become competitive with conventional magnets for applications where this is not yet the case.

The unique property of helium is that it is the only fluid at the low temperature necessary for the economical exploitation of superconductivity. Superconductivity may safely be considered to be a long term outlet for BOC's liquid helium technology (there is negligible danger of competition from other methods of refrigeration). Although the United States is using helium in ever-increasing quantities, the conservation programme should ensure availability of adequate supplies, at prices not substantially different from present prices, at least until the end of the century.

In the phase which BOC is engaged in at present, viz. exploiting small and medium size superconducting magnets, the principal requirement is for better access to the market in the UK and abroad. As far as Europe is concerned it is planned to organize better marketing and sales within the Superconductivity Department, with a view to transferring to Cryoproducts a viable activity. In view of the technical complexity of the product an attack on the US market could only be made from a base there; in such a move BOC could benefit from the fact that the UK possesses a supplier of niobium-titanium of high cost effectiveness (Imperial Metal

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Industries). BOC has good relations with IMI, even though in certain respects IMI and Murex Metallurgical are competitors.

Before embarking on future phases (whether superconducting materials, electrical machinery, etc.) questions must be answered regarding:-

(a) patents held

(b) extent of public support already committed to other companies (eg IRDC motor - possibly being licenced to GE (USA) by NRDC).

(c) BOC's knowledge of market for materials (improving rapidly) or electrical machinery (limited).

(d) Attitudes of other companies. In contrast with particularly CGE, French Thomson-Houston, GE(USA) and Siemens, all British electrical companies except IRDC (Parsons) are lukewarm in their attitude towards superconductivity. This could be due to absence of staff interested or trained in superconductivity, or pre-occupation of their managements with shorter term problems during the current phase of re-organisation of the industry.

(e) Other expertise required to make a success of new venture involving superconductivity eg special metallurgical techniques, special electrical engineering disciplines.

It is conceivable that a superconductor could be discovered having a transition temperature high enough for liquid hydrogen to be used instead of helium. But it would probably take a few years for the new substance to be developed; moreover its performance would be better at liquid helium temperatures than at liquid hydrogen temperatures. Thus the risk is minimal that BOC's investment in liquid helium technology might become obsolete in a few years.

As a remote possibility, ultra-pure normal metals might compete with superconductors in certain applications (eg underground power transmission). This should not be a major hazard because many of the disciplines which we use (electrical and cryogenic engineering) will still be required.

5 BOC's Strengths and Weaknesses

Strengths	Weaknesses
(a) Back-up on helium refrigerators.	(A) Entered field a year or two later than most competitors, notably Oxford Instruments which had built up a good reputation.
	Cannot directly exploit USA market for refrigerators; Airco agreement.
(b) Research effort probably somewhat larger than average size of competitors'.	(B) No systematic attack on market has yet been organised.
	Cannot rival certain participants, giant concerns, in the potential to spend a vast sum or to bring quickly together a large team of scientists if such measures promise to constitute basis for some kind of major break-through.
(c) Potential strength in materials, (Murex, Edwards).	(C) Certain materials suppliers (GE, Plessey, French Thomson-Houston) also make magnets and therefore are reluctant to supply BOC.
(d) Back-up in general cryogenic engineering (Cryoproducts, Edmonton)	(D) Limited immediate knowledge or expertise in existing market for conventional electrical engineering products which S/C might capture.

(e)	Availability of liquid helium for testing (Special Gases).	(E)	Representation on continent needs strengthening.
(f)	Possibility of supplying ancillary equipment (eg power supplies) made within group (Hirst).	(F)	Market for superconductivity mainly in research at present.
(g)	Salary level and low staff overheads in UK favourable to BOC.	(G)	No direct access to US market to exploit (g) opposite. Many US customers' orders might be subject to "Buy American" Act.
(h)	Superconductivity is rapid growth area.	(H)	Part of market tends to come in embarrassingly large lumps; win-all or lose-all.

6 Other Participants

The leading participating firms, in probable order of total present rate of sales in their respective markets, are as follows.

Market	US	W.Europe
Superconductor	NRC (Supercon) RCA GE Airco	NRC (Supercon) IMI Vacuumschmeltze CGE CFTH + CSF
Probable total value, pa	$7 million	£200,000 - £300,000?
Magnets (all sizes)	Westinghouse Gardner Cryogenics RCA Magnion GE Canadian Air Liquide Ferranti-Packard	Oxford Instruments Gardner Cryogenics Siemens (BOC probably 4th) French Thomson-Houston CGE L'Air Liquide Oerlikon Plessey
Probable total value, pa (Magnets only; cryostats power supplies, etc. could account for as much business again.)	$1-2 million?	£200,000 - £300,000?

(NB. £)

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7 BOC's Spending

Year	Research spending	Sales of superconducting systems
	£000	£000
Actual		
1966/7	47	Nil
1967/8	72	30
Budget		
1968/9	77	50
1969/70	78	50 - 150 depending on whether an order for a large magnet system is received.

Profitability of the superconducting systems is hard to assess at present, which is the reason for separating manufacture and selling from research within the Superconductivity Department. A figure of 20% on the selling price is consistently aimed at.

Postscript (Information received at last moment)

Indications are that the superconducting DC motor now being built for trial at Fawley is expensive in relation to its power, even omitting development costs. IRDC's case for viability of the motor seems to rest on a greater efficiency than conventional motors and the possibility of operation at much higher speeds than the 200 rpm so far used. Speeds of 3,000 rpm have been mentioned, and would be made possible through better brush design involving the Morganite Company.

23.10.68.

II BOC's STRATEGIC PROBLEM

Essential features of BOC's situation in the super-conductivity world are :-

1 Achievement of a high expertise in a field of advanced technology.

2 BOC's scientific effort well coupled to marketing realism.

3 The technology as a whole is on the brink of the unknown; possibility exists of some kind of break-through which will open worth-while markets within, say, a decade or less. BOC may be well placed to take a share in these markets.

BUT 4 No BOC access to the USA market.(Desirable on grounds of size of market and exposure to technology; not, however, an imperative step now).

5 No BOC participation, of any substantial size, in electrical and electronics industries. Direct access to their development, production and marketing skills may be a pre-condition for winning a share of the business that might follow certain kinds of break-through.

Possible Policies for BOC are :-

(i) To continue on the present course.

(ii) To seek by acquisition or joint venture, either or both of :-

a) some foot-hold in the electrical industry;

b) a business in the USA

(Joint venture to be explored only if firm incentives apparent which are not available in any other way).

Note that there could be many variations on the theme of 'ii' eg :-

- a single USA acquisition to meet iia and iib.

- two acquisitions :-
  - UK, Europe, USA, (even perhaps elsewhere?) for iia.
  - USA for iib

- iib as a purely marketing organisation; most of the labour-intensive work in research and production to remain in the UK and be done at UK rather than USA costs.

- iib as part of some wider range of USA marketing to (possibly also production for) electronics industry and laboratories; some kind of link with EHV Inc or a successor concern to it conceivable.

Any venture in the USA is likely to involve complications in view of Airco's position as licensee for "know-how" in the BOC refrigerator and purchaser of turbo-expanders made at Norden. Customers will rarely be content to accept approach by BOC/BOC associate for a superconducting system while another supplier separately offers the necessary auxiliary (necessary except with small magnets) in the shape of the refrigerator.

BOC's agreements of September 1966 give Airco rights which, in the USA, are "... exclusive except for BOC...". So the letter of the agreements permits BOC to compete, under its own name, in the USA. Nevertheless the practicability of such a step is doubtful :-

- chiefly because of repercussions for relations generally with Airco, potentially serious for BOC-Airco. Also because probably Airco would substitute some other source of turbo-expanders for Norden (already indications that they would like to make in USA; but, so far, cost deters. Turbo expander typically only some 10% of total cost of refrigerator, however).
  largely also because USA market for refrigerators is at present in phase of over-supply; keen bidding and little profit.

To sum up on the USA : BOC would quite like to own, or to be closely associated with, a business which could offer its superconducting systems in the USA. But the obstacles are very great in view of the :-

i probable need to offer refrigerators also;

ii virtual inability to offer BOC refrigerators there because of arrangements with Airco.
(To offer BOC superconducting system to USA customer with encouragement to buy Airco refrigerator is an unpromising alternative; Airco will wish to offer own superconducting system)

Negotiation for a system will often be closely linked with negotiation for a refrigerator. How far is negotiation for refrigerator linked with negotiation for subsequent supply of helium?

In practice the leading suppliers of helium are all, so far, also suppliers of hardware. There are some suppliers of hardware, however, who are not suppliers of helium.

Prima facie, if the other severe obstacles to establishing a BOC superconductivity/refrigeration hardware business in USA were overcome, then the business could succeed as a hardware business without offering helium. Nevertheless a fully integrated business, including helium supply, probably has unique merits (but would be further aggravation of the Airco relations problem).

24.10.68.

III "GCC"

Following the collapse of the proposed merger between GCC and Carpenter Steel, some very informal contacts have taken place between GCC and Mr Perham with Dr Müller. It is conceivable that, given an initiative by GCC or BOC, or both, these contacts could develop at some stage into overtures for co-operation or even a merger.

The obstacles (previous paper) to early BOC entry into the USA superconductivity business apply; but suppose somehow they were overcome (eg - however unlikely - by amicable arrangements with Airco) then what would be the incentives?

The incentives for BOC would be :-

a the USA foothold,

b the recognised entrepreneurial spirit of GCC,

c (assuming an initiative by GCC) availability; see, however points e and f below,

d (possibly, subject to study whether we really need it) access to helium via the GCC joint venture.

The disadvantages for BOC would be that :-

e this is probably not the firm that BOC would choose, given choice from a range of acquisition candidates in the USA. It is too specialised and with a speciality which too much resembles that which we already have at Morden. It is too much a duplication of existing capability.

f financial viability and prospects not at all clear; case to offer the sort of price that might be asked may be difficult to build up.

g GCC have a reputation as the reckless member of the club; BCC would wish to avoid this taint.

To try to look at it through GCC's eyes, their main incentives are probably :-

h that financially they need a 'life-belt' after a period of losses.

i that their management itches to run a business with somewhat broader product range, though involving similar concepts and markets.

j that their management wants to have a lot of autonomy and this they might retain as a USA outpost of BCC.

The disadvantages in their eyes would be :-

k loss of control, though they were ready for this anyway in the Carpenter proposal.

l fear that BCC's links with Airco might lead, in due course, to some submerging of their identity in some kind of joint venture (here GCC may regard the Justice Department and the federal trade laws as a friend).

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APPENDIX III

GARDNER CRYOGENICS CORPORATION

CX-15-Z-2

Preliminary Financial Assessment

Introduction

Company formed 1961 by W. A. Gardner, previously of Air Products. Gardner is 38 and owns approximately two thirds of the share capital.

GCC is a 50% partner with the Alamo Chemical Company, a subsidiary of Phillips Petroleum Company is a joint venture which produces helium by extraction from natural gas in Kansas. The helium is sold to GCC, other by-products (hydrocarbons) to Phillips, and the purified natural gas returned to the original supplier. Alamo Chemical operates the plant.

The basic business of GCC is sale of liquid and gaseous helium delivered in bulk quantities throughout the USA, but the company is also involved in manufacture and sales of cryogenic plant and equipment.

Financial Information

GCC is not a public quoted company and therefore information is limited.

Turnover for the joint venture for 1968/69 is expected to be over $10 million (£4 million).

Turnover for GCC is estimated at present to be $10 million (95% of these sales are in the USA. The other 5% probably represents sales of liquid helium to Northern Europe 'at what were considered by the industry as dangerously low prices' - European Chemical News 24/5/68).

GCC capital employed is approximately $5 million (£2.1 million) of which $3 million is financed by bank overdraft. The balance of $2 million is presumably equity capital and reserves.

GCC profits are expected to be $200,000 (£83,000) for the year to 30 June 1969, as against a loss of over $1 million (£420,000) the previous year. The loss was attributed to start up difficulties at the helium extraction plant necessitating purchase of helium at higher prices elsewhere.

Profits of $200,000 represent a return of 4% on capital employed $5 million and a return of 2% on turnover of $10 million.

If profits are after deducting interest, then adding back interest of $210,000 (7% of $3 million) gives pre interest profit of $410,000, return of 8.2% on capital employed of $5 million and 4.1% on estimated turnover of $10 million.

Valuation of Company

The take over bid from Carpenter Steel Company for GCC earlier this year was initially accepted, but later W. A. Gardner turned the offer down. The reason given by Gardner was his belief that a much larger concern (International Controls) was about to gain control of Carpenter and that he, Gardner, would lose his independence within the Carpenter organisation.

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The bid from Carpenter Steel consisted of 100,000 convertible preferred shares paying a dividend of $200,000 in years 1 to 3 and $450,000 thereafter. The shares were redeemable after 5 years at $120 per share at Carpenters option. Conversion rights per share consisted of 2 2/3rds shares of Carpenter during the 2nd and 3rd years, and thereafter 3 Carpenter shares.

The valuation of this bid is estimated as follows:-

	Valuation ($ million)	
Dividend of $450,000 (5% yield)	9.0	(1)
Conversion Rights (at 2 2/3rds Carpenter shares)	10.2	(2)
Conversion Rights (at 3 Carpenter shares)	11.5	(2)
Redeemable at $120 per share	12.0	(3)

(1) Based on average American preferred dividend yield for 1967.

(2) based on Carpenter high price for 1968

(3) cost to Carpenter if the preferred shares are redeemed.

The $9 million represents the minimum value of the offer; a safety factor in case the Carpenter share price drops, causing the conversion rights to fall in value.

The $12 million represents the guaranteed price to the GCC shareholders should Carpenter Steel decide to buy them out.

Value to BCC

Sales of $50 million are forecast for 1975. This represents a growth rate of 30% p.a. This compares with a sales growth rate for helium in the USA of about 11% for 1962-1966, and of 25% in 1966. Helium consumption in the USA is expected to increase from about 650 million cu. ft. in 1965 to 2,000 million cu. ft. in 1975, a growth rate of 12% p.a. Therefore the GCC forecast of $50 million in 1975 must be based to a great extent on an expansion of cryogenic plant and equipment sales rather than helium sales.

or market share?

Assume

(a) (i) Sales increase at 30% p.a. from 1969 ($10 million) to 1975 ($50 million); at 10% for the following 3 years until year 10; thereafter remain static.

(ii) Pre tax profit margin is 5% of turnover (compared with 2% in 1968)

(iii) Tax at 48%, but allowing for $1 million tax loss brought forward.

(iv) Capital requirements in excess of depreciation amounting to $250,000 in 1969, (5% of $5 million capital employed) thereafter increasing at 10% p.a. until year 10.

(b) As (a) except pre tax profit on turnover to be taken as 10%.

These future projections of profit over a 20 year period on a 15% DCF return would give present day values of (a) $ 4.6 million
(b) $10.5 million

Projection (b) with a 30% p.a. sales growth and a 10% pre tax profit margin, approximately equates to the value of the Carpenter bid.

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Conclusion

GCC is a small company competing with large companies (Air Reduction have over 50% of market; other competitors include Linde and Air Products) in a capital intensive industry. With gearing at about 60%, the company is evidently at the limit of its financial resources, and cannot expand without further injections of capital. The price agreed by Carpenter at over $10 million appears excessive in view of current profits, and can only be justified by an exceptionally high growth rate of Sales together with big improvements in profit margins, as above.

Finance Planning
24 October 1968

CX-15-2-5

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GCC - Notes and Queries

1. What is exact relationship between GCC and Alamo Chemicals?

   (a) According to the Carpenter circular, the 'joint venture is concerned with the manufacture and sale of cryogenic equipment'. Confirm that this is not so, and that joint venture only concerned with extraction and sale of helium.

   (b) What contribution does the joint venture make to GCC profits?

   (c) Does the joint venture sell helium to GCC at an economic price?

   (d) Will the new Phillips plant sell helium to GCC on the same terms as the joint venture?

2. GCC sales are estimated for the current year at $10 million and for 1975 at $50million. Present capacity of the joint venture plant is 140 million c.f. p.a. The new Phillips plant capacity is 300 million c.f. p.a. The standard USA government price for helium is $35 per '000 c.f.

   How does this compare with GCC current selling price and to whom does GCC sell? At the price of $35 for '000 c.f. the value of 140 million c.f. is $4.9 million, and of 440 million c.f. is $15.4 million.

   The Phillips plant is not yet in operation, which seems to indicate GCC's current $10 million turnover must be half gas, half equipment, yet Mr. Perham reports sales have been primarily helium.

   (a) What makes up the balance in the current sales - is helium bought elsewhere, or is the balance made up of equipment sales?

   (b) The $50 million sales forecast for 1975 represents a growth rate of 30% p.a., yet forecast market growth of helium sales in USA is only 12% p.a.

   How, therefore, will the 30% growth rate be achieved -

   (1) by increasing market share of helium sales?

   (2) by expansion of cryogenic equipment sales?

   (3) by diversification or acquisition? or

   (4) is information incorrect?

3. The basis for future sales growth having been established, also the sales product mix,

   (a) what profit margins will be achieved? (Would have to be substantially better than the 2% envisaged for 1968/69 to justify BOC investment).

   (b) What further capital expenditure will be required to meet sales forecast? Who will bear this cost? - (Phillips?) It would appear that the combined capacities of the J.V. plant and Phillips plant only total $15 million which a 30% sales growth would exceed after 2 years assuming all sales are gas.

   (c) What additional working capital requirements to meet sales forecast?

CX-15-Z-6

4. One explanation given for the £1 million loss last year (1968) was the need to buy helium at higher prices elsewhere due to the delay in start up of the helium extraction plant operated as a joint venture, but in previous years GOC would have had to buy helium from other sources, and presumably made profits: why such an increase in price?

5. We require to have detailed balance sheets and profit and loss accounts for past 5 years. In particular we need to know:-

Profit and Loss Items

(a) Sales figures - volume and value.

(b) Trading profit margins

(c) Interest and depreciation (including basis) charges.

(d) Pre tax and post tax profits

(e) Dividends, if any.

Balance Sheet

(a) Analysis between fixed assets, working capital and investments (presumably would include investment in joint venture).

(b) Analysis between sources of finance - equity capital, loans, bank overdraft, etc.

6. A breakdown of net fixed assets is required, including up to date values where they differ materially from book values.

7. Motives for Gardner wishing to sell:

(a) he wishes to obtain the financial backing of a large group, yet at the same time remain in control.

This would suit BOC provided we get an adequate return on our investment.

(b) Gardner may also wish to safeguard the value of his investment and so protect his family. As it is, the value of the company is to a large extent dependent upon him personally.

8. Should the acquisition be commercially justified, the question will arise as to the best method of financing the deal. This will require detailed financial consideration; much may depend upon Gardner's personal tax circumstances. Cash is unlikely to be acceptable to Gardner because of capital gains tax.

A scheme offering convertible stock carrying the right to take up a predetermined number of BOC shares in the future, combined with an alternative of taking an agreed cash amount, would be similar to the Carpenter arrangement and might have possibilities.

It is clear that having turned down an offer from Carpenter worth approximately £4 million, Gardner

(a) values the future profit potential of his company very highly (on past performance the company is clearly worth far less)

and (b) would not be prepared to accept much less.

CX-15-2-7

A 3894

BCC would surely be unwise to commit itself, or pay immediately, such a figure for this company and for entry into the States. Some compromise arrangement might be evolved whereby Gardner could be issued with convertible stock now, carrying a modest interest rate, but convertible into BCC shares, at varying scales, in accordance with development of GCC profit, the options being exercisable after such periods, say of 2, 3, 4 and 5 years.

9. Perhaps not for discussion with Mr. Gardner, ought we not to question with Mr. Perham his comment that the business of Cryo-products, EHV and Murex might be expected to enjoy an additional £15 million of sales beyond the optimistic projection provided by Gardner, by virtue of assosciation with GCC. He does not explain how this extra turnover would be achieved.

Finance Planning
24 October 1968

CX-15-2-8

GARDNER CRYOGENICS CORPORATION

Five Year Forecast

	1969	1970	1971	1972	1973
Sales	$13,208,943	$17,359,936	$24,400,067	$36,377,825	$48,279,236
Cost of Sales	9,163,008	12,392,013	16,808,140	25,405,270	33,646,424
Gross Profit on Sales	4,045,935	4,967,923	7,591,927	10,972,555	14,632,812
Corporate Expense	980,000	1,010,000	1,130,000	1,250,000	1,500,000
Net Profit	3,065,935	3,957,923	6,461,927	9,722,555	13,132,812
Alamo Share of Profits	1,032,967	1,322,710	2,340,500	3,240,000	4,400,000
Gardner Share	2,032,968	2,635,213	4,121,427	6,482,555	8,732,812
Expense Not Chargeable to Joint Venture	181,000	210,000	245,000	260,000	300,000
Gardner Net Profit before Taxes	$ 1,851,968	$ 2,425,213	$ 3,876,427	$ 6,222,555	$ 8,432,812

4,38#1

A 3835 Cx-17

168 Valley Road
Watchung, New Jersey 07060
December 30, 1968

Mr. Leslie Smith
The British Oxygen Co., Ltd.
Hammersmith House
London, W. 6
England

Dear Leslie:

In accordance with our recent discussion in London, I met with William Gardner at his headquarters in Bethlehem, Pennsylvania, on December 12 and terminated further negotiations between BOC and Gardner Cryogenics relating to the possible acquisition of this company by British Oxygen. My meeting with Gardner was very cordial, and he seemed quite understanding of the reasons for lack of further interest in his company on the part of British Oxygen.

In closing this matter, he indicated he would immediately like to reopen his commercial relations with BOC as a supplier of helium, pointing out that this activity had been placed in abeyance pending the outcome of the acquisition discussion. I informed him that I would advise you of his intentions and that I anticipated no difficulty in this regard.

I have kept Allan Perham informed of all the above developments, including our discussion in London and my meeting with Gardner.

With best wishes for the new year.

Very sincerely yours,

Albert Muller

AM:ggc

A3896

1968 CONSULTING ACTIVITY

by

Albert Muller

January 10, 1969

Albert Muller

1968 CONSULTING ACTIVITY

In April of 1968 an agreement was executed with BOC which provides for consulting services in the following areas:

I. Development of promising business opportunities for BOC in the U.S. and with U.S. companies elsewhere.

II. Identification and critical analysis of new products or processes falling within BOC's range of interests and generally assisting BOC's corporate planning in this regard.

III. Studies of the environment in which the industry represented by BOC is expected to operate in the period ten years ahead, both in the U.S. and elsewhere in the world.

IV. Technological forecasting of U.S. trends which may have significant impact on present BOC business and future plans.

No rigid order of priority was established with respect to these areas, it being felt that a pattern of specific interests would evolve in the course of the program.

In order to conduct these activities effectively, a reasonable knowledge of the general objectives, specific strategies and management attitudes of BOC is necessary. Accordingly, four trips to the U.K. were made in 1968 for the above purposes. A total of 25 working days (32 calendar days) were spent in business and technical discussions and facility visits during these trips. This has provided

the necessary background for work in the U.S. In addition, some time has been spent in Canada and the U.S. becoming familiar with the operations and future plans of the Canox organization in Toronto, and the Edwards High Vacuum operations at Grand Island, New York and Oakville, Ontario.

Of immediate interest to BOC, particularly as it relates to its short-term financial objectives, is area I above. The U.S. market represents approximately 50% of the world market and, therefore, it goes without saying that any company which entertains the desire to grow and become a "world company" must seriously consider ways of entering the U.S. market on a <u>significant basis</u>. (BOC's lone present business interest in the U.S., Edwards High Vacuum, does not have a significant position in the U.S. vacuum market, controlling less than 1% of this market.) A unique characteristic of the U.S. market which is important to an overseas company investing in U.S. business is that in many areas the technology of the U.S. marketplace generally leads that of other world markets by an appreciable time factor; from three to five years with respect to western Europe and by a greater differential in other areas of the world. In analyzing the best approach to the U.S. market for BOC this factor is of importance in that an entry into a high science business of this type in the U.S. will provide an opportunity for BOC to employ this know-how later at home and in other overseas markets at an appropriate future time. This "extra benefit" from a carefully selected acquisition can be significant in future years.

CA-18-D

After considering BOC's available resources for U.S. investment, the need for reasonable ability to judge and control a U.S. operation from U.K. headquarters, the growth and profit potential required to meet existing objectives and the nature and extent of available opportunities in the U.S., it was decided early that the most promising fields to examine in the area I program were not related to the traditional businesses of BOC, but rather to the new high technology content fields entered more recently. These in turn are related to the metallurgical (metals and welding), vacuum, cryogenics, medical, chemical (including gases), and consumer product interests of BOC. In other words, no attempt has been made to contact organizations selling products of a "commodity like" nature, where growth and profitability have leveled off and where future position depends on large scale plant and equipment investments and extensive distribution facilities, both of which tend to be rather capital intensive.

It was also recognized early that the technical position of BOC in some of its businesses was excellent. In fact, in many places it is at least as good, and possibly superior, to that of comparable groups in the U.S. This asset has been used to attract U.S. companies engaged in similar or related activities, with the intent that by amalgamation into a single stronger unit, a superior technical, production and marketing capability can be created with potential greater than that of the individual organizations taken separately. This point has proven to be of critical importance in developing an interest on the part of many U.S. companies in working closely with BOC.

Some of the technical capabilities of BOC in the areas of deep-low-temperature technology, superconducting magnets and vacuum technology are particularly significant to U.S. organizations at this time, particularly where the U.S. organization possesses complementary technology, e.g., superconducting materials capability to go with the BOC superconducting magnet technology. The synergism created by this type of rationalization also opens up the potential market for systems involving the integration of several such items into a more complex unit.

A good example of this approach would be to combine the existing superconducting magnet capability of BOC with a superconducting materials capability. These then can be coupled with BOC's low temperature refrigerators, cryogenic containers and piping, power supplies, controls and instrumentation, so that complete superconducting magnet systems may be sold on a worldwide basis, instead of the currently practiced more limited sale of individual components in the European market. How to bring the presently fragmented management responsibilities within BOC to accomplish the above is a separate problem outside the realm of this discussion.

With all of the above in mind, a number of organizations have been contacted in the U.S. to ascertain whether or not there are mutual interests that can be explored in greater depth. Those organizations with whom serious discussions have been held are listed in Table I which shows the areas of interest discussed and the present status of negotiations. It should be noted, for example,

that the first four organizations have activities which relate to BOC's cryogenic interests, the next three with chemicals and gases, the next three with metallurgy, a group with medical products, and finally, a single organization in the service area. Even though there was no interest in this last organization, the services area is of particular interest since the growth rate of service industries during the next ten years will far exceed that of most product industries.

It seems worthwhile to point out that BOC's interests in U.S. companies should not be limited to one organization in a given field. To accomplish a given objective such as the creation of a strong worldwide organization in the vacuum equipment field may require that several organizations be acquired and assembled into the final unit. Similar situations exist in other areas of interest to BOC.

Turning now to area II, an attempt has been made to monitor, analyze and report new developments in the fields of interest to BOC through oral discussions with the appropriate trading division technical personnel, the central research group at Morden, and the central planning group at Hammersmith House. Some of the more significant topics that have been reported informally and discussed in this fashion have been:

1. The use of vacuum, cryogenic and superconducting magnet technology in the high energy physics market.
2. Thermonuclear power generation and its implications to cryogenic and superconducting technology.

3. Superconducting power transmission, generation, transformation, etc.

4. Advanced welding processes; ion-beam; electron-beam; laser-beam; vacuum-bonding; ultra-sonic; etc.

5. Plasma technology.

6. Ultra low temperature technology (below 2°K).

7. Small closed cycle refrigerators for use in electronic detection and guidance systems.

8. Electron-beam and ion-beam vacuum coating and melting techniques.

9. Use of ozone for tertiary water treatment.

10. Desalination.

11. Medical instrumentation.

12. Closed cycle breathing systems for deep submergence.

13. Composite materials.

14. Advanced polymers as specialty chemicals.

15. Hyper-refined metals for electronic and aerospace use.

In most of the above cases this information was of general interest and useful, but some knowledge of the subject matter was generally already known to BOC personnel, and it is felt that the primary benefit resulting from these discussions involved requests for more specific data in given areas, plus a sharpening of focus with respect to the implications of initiating research in certain of these areas.

The information obtained has been the result of personal contacts, attending meetings of technical societies and visits to various industrial organizations and Government laboratories. Some of the important visits and discussions are listed below:

1. U.S. Atomic Energy Commission
   a. Thermonuclear Power Group, Washington, D.C.
   b. Brookhaven National Laboratory, Upton, New York
2. Cryogenic Engineering Society, Chicago, Illinois
3. Cryogenic Conference, Cleveland, Ohio
4. American Vacuum Society Meeting, Pittsburgh, Pennsylvania
5. New York Society of Anesthesiologists, New York, New York
6. Howmet Company, Austenal Division, Dover, New Jersey
7. W. W. Dickenson Company, San Francisco, California
8. Boeing Company, Seattle, Washington
9. Project TRIUMF, University of Vancouver, British Columbia
10. Fansteel Company, Baltimore, Maryland
11. U.S. Bureau of Mines, Helium Division, Washington, D.C.
12. Stanford Research Institute, New York, New York

In area III, comparatively little work has been done except to monitor various publications which have projected the environment expected in the period ten years ahead. There appears to be general agreement with respect to the following:

1. Change on every level--global, national, institutional, product and personal--will continue to occur on an accelerating basis in the next ten years. Since each of these areas is

attractive, all sectors will influence and be influenced by developments taking place in individual areas.

2. The gap between the developed and underdeveloped nations will continue to widen which will intensify problems between the two groups. Large increases in the populations of the less developed countries may cause critical food shortages unless some population control is practiced in certain areas of the world. This situation is not expected to change until something is done to motivate and change the attitudes of the underdeveloped peoples.

3. Science and technology will continue to be the most prominent force for change in the coming decade.

4. Economic growth will continue in the developed countries at about the same average rate in the decade ahead as has been experienced during the past five years.

5. In the U.S. and other developed countries, the growth and responsibilities of federal governments will increase as the needs for federal participation in national matters such as education, civil rights, medical care, housing and urban development, transportation, defense, science and technology, and control of the physical environment increase. National governments will increasingly be concerned with the protection of individual rights, particularly where protection from extreme hardship is involved.

6. With the prospect for good economic growth in the developed countries in the coming decade, trade and investment will expand and business operations will require stronger international orientation. This internationalization of the business community will increase the need for cooperation among nations and influence the pattern of world affairs, in both the political and social areas. Nationalistic trends, particularly in Europe, will have a strong influence in this area, but it is expected that the general trend toward cooperation will increase rather than decrease in the years ahead.

No attempt has been made to translate any of the above in terms of suggested strategies to BOC. It is recommended that this subject be pursued in greater depth in the coming year.

In area IV, technological forecasting, little progress has been made in 1968 because of the lack of available time to pursue this matter in depth and the complex nature of the subject matter involved. Technological forecasting today is more of an art than science and is inherently more difficult than economic forecasting because a longer time span is involved. Arguments over the best way to forecast are pointless at this time, since not enough is known about the accuracy of the methods available. In general, the approaches employed have as their basis the substitution of a quantitative analysis that predicts the probability of a future event, to replace the usual individual intuitive judgment. The dozen or so techniques that

can be employed generally fall in three classes:

1. Forecasts based on the past
   a. Leading indicators
   b. Envelope curves
   c. Analogy
2. Forecasts based on the future
3. Forecasts based on dynamic models

An excellent summary of these techniques, together with specific recommendations to BOC management, is contained in Planning, R & D Report No. 3906 issued by Morden April 12, 1968. A program to try these techniques on a limited basis was approved for 1969 at the recent December research meeting held at Hammersmith House.

Aside from all of the above, some time was spent in 1968 assisting BOC personnel with their travel schedules in the U.S. This included visits with staff personnel to a variety of locations and minor follow-up with respect to unfinished details. In all, it has been a busy nine months.

January 10, 1969
Attachment - Table I

ORGANIZATIONS CONTACTED

COMPANY	REASONS FOR CONTACT	AREAS OF INTEREST	STATUS
Helix Technology Corporation Waltham, Massachusetts	Acquisition/joint venture in U.S. and U.K.	Small closed cycle cryogenic refrigerators (sterling cycle); cryogenic systems; cryogenic instrumentation.	No interest in acquisition by BOC. Commercial interest in resale of units by BOC in U.K. still under consideration.
Cryogenic Engineering Co. Denver, Colorado	Acquisition/joint venture in U.S.	Cryogenic hardware and systems for ultra-low temperatures.	Pending.
Cryomagnetics Denver, Colorado	Joint venture in U.K. and U.S.	Composite superconducting materials.	Pending.
Gardner Cryogenics Bethlehem, Pennsylvania	Acquisition in U.S.	Helium (U.S. and overseas). Cryogenic hardware. Process equipment.	No interest in acquisition by BOC. Terminated.

(continued)

A 39017

CX-X-7

COMPANY	REASONS FOR CONTACT	AREAS OF INTEREST	STATUS
Synvar Wilmington, Delaware	Acquisition in U.S.	Adhesives for plywood fabrication; graphite impregnated bearing and seal materials.	No interest in acquisition by BOC. Terminated.
International Harvester Co. SOLAR Division San Diego, California	License under patents and know-how in U.K.	Polyimide resins for coatings and adhesives.	Pending.
Clinton Oil Company Wichita, Kansas	Joint venture in U.S.	Helium gas and liquid.	Pending
Thermal Dynamics Lebanon, New Hampshire	Acquisition/licennes under know-how and patents in U.K.	Plasma welding and cutting equipment and technology.	Pending.
Hart Metals Tamaqua, Pennsylvania	Commercial agreement for resale of each company's products in U.S. and U.K.	Production of spheroidal metal powders of low melting metals for pyro-technic devices.	No interest by BOC. Terminated.

3905

COMPANY	REASONS FOR CONTACT	AREAS OF INTEREST	STATUS
Aeroprojects Incorporated West Chester, Pennsylvania	License in U.K. under patents and know-how; possible joint venture in U.K.	Ultra-sonic tube and wire drawing equipment and technology.	Pending.
Energy Beams, Inc. Haskell, New Jersey	Acquisition in U.S.	Electron and ion beam equipment for melting, evaporation, welding vacuum accessories.	Pending.
Hill Ross Incorporated Milwaukee, Wisconsin	Commercial agreement covering medical products sale in U.K. Possible acquisition of Mathieson Special Gases Divisions in U.S. and Canada.	Disposable medical products. Special gases.	Pending.
C. R. Bard Murray Hill, New Jersey	Commercial agreement covering medical products sale in U.K.	Disposable medical products.	No further interest on part of Bard. Terminated.

CX-12-2

COMPANY	REASONS FOR CONTACT	AREAS OF INTEREST	STATUS
Statham Instruments Oxnard, California	Commercial agreement covering medical instrumentation sale in U.K.	Medical instrumentation.	Pending.
Andar, Inc. Mountain View, California	Acquisition in U.S.	Special vacuum pumps and equipment.	Acquired by Veeco. Terminated.
International Underwater Contractors, Inc.	Establishment of joint venture in U.K.	Underwater diving and construction services; advanced life support equipment and systems. Special gases.	No interest on part of BOC. Terminated

A 39110

BC: Mr. D. W. E. Stafferton

168 Valley Road
Watchung, New Jersey 07060
U.S.A.
January 24, 1969

BEST COPY AVAILABLE

Dr. Nicol Gross
The British Oxygen Company Limited
Hammersmith House
London, W. 6
England

Dear Dr. Gross:

In my rush to send you the two reports which I recently prepared, I was not able to proofread these documents before they were mailed. As a result, there are a few errors which should be corrected. These are shown on the attached list. I would greatly appreciate it if you would ask Mrs. Jameison to make these corrections on the copies in your hands.

During the past week, I visited Statham Instruments, Inc., at Oxnard, California, and examined and discussed their medical instrumentation product line. I was particularly impressed with their patient monitoring equipment. Several systems involving equipment to monitor pulse rate, respiration rate, blood pressure (venous and arterial), temperature, electrocardiogram and electroencephalogram for as many as thirty patients simultaneously have been installed in hospitals in the U.S. and Canada. These installations are becoming more common in intensive care units where trained manpower to perform all of these functions on multiple patients is lacking. Messrs. W. F. Johnson and G. Woodliff appear quite interested in having a reputable organization in the U.K. take on their product line and are looking forward to discussions with Don Stafferton early in March when they visit the U.K. Unfortunately, I was unable to meet with Mr. Statham during my visit so that I did not get a chance to discuss their possible interest in being acquired. Sales in their fiscal year ending May 31, 1968 were just over $12 million, sharply down from $15.6 million the year previous. This was due to a sharp drop in the sale of aerospace and industrial instrumentation with profits falling from $1.6 million to $0.13 million as a result. I expect to receive appropriate literature shortly and will either forward this or bring it with me on my next visit.

CX-19-B

I also visited the International Harvester Company, SOLAR Division, at San Diego to discuss the possibility of licensing their polyimide technology. SOLAR is definitely interested in further discussions on this subject, but is unwilling to reveal its technology until a suitable confidential disclosure agreement is executed with BOC. As soon as I have further information in this regard, I shall be in touch with John Williams on this matter.

Invoices for my current expenses are attached.

With my best wishes.

Very sincerely yours,

Albert Muller

AM:ggc
Enclosures

AM:ggc

A 3913

CK-19-C

ERRATA

REPORT ON "1968 CONSULTING ACTIVITY"

Page 8, line 1 - "attractive" should be changed to "interactive"

REPORT ON "IMPROVING THE EFFECTIVENESS OF RESEARCH AT THE BRITISH OXYGEN COMPANY"

Page 3, line 5 - "live" should be changed to "line"

Page 3, line 20 - "involutionary" should be changed to "evolutionary"

Page 8, line 21 - "involvements" should be changed to "involvement"

AM:ggc

January 24, 1969

TO: The British Oxygen Company, Ltd.
Hammersmith House
London, W. 6
England

FROM: Albert Muller
168 Valley Road
Watchung, New Jersey 07060
U.S.A.

Consulting Services: [illegible]

January, 1969.....$2,750.00

[illegible]

Albert Muller

[illegible]

CX-19-E

A 3915

January 24, 1969

TO: The British Oxygen Company Ltd.
Hammersmith House
London, W. 6
England

FROM: Albert Muller
168 Valley Road
Watchung, New Jersey 07060
U.S.A.

Expenses for the Period December 16, 1968-January 15, 1969 Inclusive:

Miscellaneous Office Supplies	$ 27.87
Part-time Secretarial Service	222.50
Telephone and Communications	37.79
*Travel	614.25
TOTAL	$902.41

* - Includes first-class air fare, New York to San Diego, and return.

Albert Muller

CX-23-A

A 3916

168 Valley Road
Watchung, New Jersey 07060
U.S.A.
March 28, 1969

Mr. L. E. Smith
The British Oxygen Company Limited
Hammersmith House
London, W. 6
England

Dear Leslie:

Since I last wrote you with respect to my activities, I have had to spend considerable time slowing things down with those organizations which I had contacted with respect to potential BOC interests in the United States. I have explained to the principals of these companies that you have been out of England on an extended trip and that it was not appropriate for me to go to England during your absence. I have visited Denver, Los Angeles, and other locations on the East Coast to handle this situation on a personal basis, since I am quite anxious to avoid leaving the impression that BOC is not interested in further negotiations. In this connection, visits were made to the following organizations:

1. International Harvester Company
   SOLAR Division
   San Diego, California

2. Whittaker Corporation
   Narmco Division
   Costa Mesa, California

3. Statham Instruments
   Oxnard, California

4. Cryomagnetics Corporation
   Denver, Colorado

5. Cryogenics Engineering Company
   Denver, Colorado

6. Thermal Dynamics
   Lebanon, New Hampshire

L-27. Aeroprojects Incorporated
West Chester, Pennsylvania

8. Materials Research Corporation (MRC)
Orangeburg, New York

9. Malaker Corporation
High Bridge, New Jersey

10. National Tape Corporation
South Plainfield, New Jersey

In all of the above cases, discussions had been initiated which relate either to licensing or joint venture/acquisition relationships with these companies. All organizations have expressed interest in carrying the discussions further, and it was my intent to review each of these with you and your staff during my trip to England originally scheduled for early March. I do not believe it will be possible for me to hold these individual matters open indefinitely. I should like to suggest, therefore, that either I come to England to review the situations at an early date or that the appropriate chief executives come to the United States for direct discussions.

Perhaps the most urgent situation is that relating to MRC which is of interest to Bill Smith. He is reasonably familiar with the status of this matter, but, of course, has not been filled in on many of the small details which cannot conveniently be put into an ordinary letter. This same situation impinges on Murex which I had hoped to discuss with John Williams during his recent trip to the U.S. Unfortunately, however, we were unable to get together, and, as of this time, he is probably not familiar with this subject unless he has been filled in by Bill Smith.

As you probably realize from all of the above, I believe an early meeting is needed so that I can obtain some guidance with respect to the disposition of these individual possibilities. I can come to England during April if this seems appropriate, but I cannot leave the country late in the month or early in May due to other commitments.

I shall appreciate hearing from you with respect to the above at an early date.

LX-23-C

43918

Mr. L. E. Smith - 3 - March 28, 1969

Invoices for my March consulting fee and expenses for the period February 16-March 15, 1969, inclusive, are attached.

Kindest personal regards.

Very sincerely yours,

Albert Muller

AM:ggc
Attachments

A 3919 CX-25-A

THE BRITISH OXYGEN COMPANY
LIMITED
HAMMERSMITH HOUSE LONDON W6
RIVERSIDE 2020 TELEX 22833 BRITOXYGEN LONDON W6

1st April 1969
LES/ES

Dr A. Muller,
168 Valley Road,
Watchung,
NEW JERSEY 07060,
USA.

Dear Al,

Many thanks for your letter of 28 March. I can well understand the frustration you must have felt during the last month or two. This is my fault. Nicol's death, followed by our changes in top management, followed immediately by my visit to Australia, all absorbed several weeks. In addition, we (the two new Managing Directors and I) needed, and still need, time to think out our direction in a number of areas.

Let me first briefly explain the changes in top management. I am now Group Managing Director with main responsibilities for Group policies on development, planning, finance and so on. Peter Laister and John Williams are Managing Directors, charged with prime responsibility for the direction of the UK trading activities. Each has specific areas on which he reports direct to BOC Board. Matters are so arranged that any one of the three of us can cover for the other two should the occasion arise. Chris Hesketh-Jones, still Chief Executive Overseas, has been appointed to the BOC Board.

Peter Laister's specific responsibilities are for:

Chemicals and Metallurgical Division
Equipment Division
Welding Products Division
Public Relations and Marketing Services
Europe
Edwards High Vacuum

John Williams' specific responsibilities are for:

Gases Division
BOC-AIRCO
Research and Development
Management Services
Personnel
Legal and Secretarial

If we now turn to the contribution you are making, I suggest this can best be summarised as:

(a) Proposals for business opportunity and development in USA.

(b) Advice and assistance in the selection of promising lines for research and development.

It becomes clear immediately that your work is of interest to me, the two Managing Directors, CE Overseas and most of our Chief Executives.

In addition, and perhaps less obvious, Allan Perham is heavily involved. Because of our spread of interest throughout the world, we are tending to develop wherever possible a regional pattern of control and communication. The rate of progress depends partly on political considerations and partly on our ability to provide proven Group management. Our first positive steps have included asking Allan Perham to assume responsibility for progressing development opportunity in North America.

In all this, the paramount need to my mind is that we establish clear lines of communication for you. We have to adapt our communication and organisation to keep pace with the speed with which you turn up opportunity and not the other way round. To achieve this in practice, we believe the following procedure should be adopted:

(1) All proposals which provide business opportunities for BOC in the USA should be referred in the first place to Allan Perham. If you and he agree, you should jointly engage in the preliminary discussion and enquiry.

(2) Allan Perham will use his normal channel of communication, ie to CE Overseas, to keep London advised of progress on those proposals which appear to hold promise.

(3) CE Overseas will assume responsibility for keeping all interested parties informed here in London. He will also be responsible (after agreement with you and Allan Perham) for advising on the appropriate time for any direct intervention by a BOC Managing Director or Chief Executive.

Turning /

Turning now to your second main contribution, ie assistance in R & D, it seems to me that time is not such a critical factor. Communication could well take the form of a quarterly, or perhaps half-yearly, written report, supplemented by two or three visits a year to UK. Because of the different nature of this part of your contribution - though I appreciate the interlinking with the search for business opportunity - I cannot see any great harm if you communicate through a different channel. In this case, direct from you to John Williams who has over-all charge of our R & D effort.

I am sending a copy of this letter to Allan Perham and, of course, you are free to discuss it with him. Having in mind also the formidable list of companies with which you have opened discussions, everything points to the need for both you and Allan Perham to come to London in April - say 23/25. This will give you time to brief Allan Perham where necessary and will still get you back in the USA for Norman Reckitt's visit.

Regards,

Yours sincerely,

Leslie

CX-2C-A

A 3922

PROPOSED VISIT TO USA BY D. A. D. MORGAN

MAIN POINTS TO COVER

1. Boc in Medical Market

Determine reasons for limited market penetration -

- inadequacy of product range?
- inadequacy of marketing methods?
- inadequacy of marketing effort?

Are there preferable alternatives? -

- direct marketing/selling operation in key areas with or without Har is manufacturing?
- acquiring and/or enlarging Harris operation? (N.B. How much does Harris name now count for in US medical market?)
- alliance with another concern, e.g. gas company or supplier of complementary medical products with established marketing resources? (N.B. NCG at present market Fraser-Sweatman range - successfully?. Other possible McKesson)
- Concentration on specific market/product areas? Investigate market structure

Discuss with Harris and Canox. Visit cross-section of hospitals to investigate method of purchase - who determines supplier, does Harris figure?

Find out how Ohio/Forregger and others operate and why. Visit medical supply houses to see how far they influence purchasing choice. What calibre of salesmen do they have?

2. Fraser-Sweatman/Cyprane position

Evaluate scope and success of this concern in USA and Canada. Does it lean heavily on vaporisers? If acquisition made what value, if any, would the F-S range and marketing arrangements have for BOC.

How? Ask Harris/Canox. Evaluate from hospital visits.

3. Intensive Care

What is the potential in this field? Are there any new technical/organisational methods which BOC could note? What problems have arisen?

Is our proposed approach suitable for US market - in part - as a whole?

Visit major hospitals with ICU's.

4. Inhalation Therapy

How is this market developing? Sharp growth? Accepted form of treatment?

Where? i.e. specialised hospital department?
specialised clinics?
domiciliary?

Attitudes of medical profession - changing?
Are there factors peculiar to US which would not apply elsewhere?

How? Visit Bird and US hospital with IT units.

5. New Developments

a) In anaesthesia and patient care.
What opportunities do these offer BOC?

b) Developments in other fields, e.g. -
- Diagnostic methods
- Heart surgery
- Transplant surgery
- Prosthesis
- Laboratories

Trends, leading suppliers, constraints. Opportunities for BOC manufacture/factoring?

6. Background

What are effects on market of:

i) Private medical treatment

ii) Shortage of labour (more acute in US than UK)

iii) Development of service organisations, e.g.

Laboratories
Sterilisation services
Maintenance services

iv) Where do UK manufactured products score and why?, e.g. labour cost advantage.

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CONFIDENTIAL

EQUIPMENT DIVISION

VISIT TO NORTH AMERICA

- by -

MR D. A. D. MORGAN

BUSINESS PLANNING MANAGER, MEDICAL/AVIATION

12 - 30 MAY 1969

Summary of Conclusions — Pages 1/3

Visit to Canada 13 - 17 May:

Discussions with Canox	Section A
Current problems	" B
Visit to Fraser Sweatman 16 May	" C
Visit to Canadian Hospitals	" D
Quebec Hospitals Convention/Exhibition	" E

Visit to USA 18 - 29 May:

Discussions with Harris Calorific	" A
Congress of Anaesthesiology	" B
Current Problems	" C
Development	" D
Visit to Hospitals	" E
Allied Therapy, San Francisco	" F
Variflo, California	" G

Distribution:

Mr D. W. E. Stafferton	- Cricklewood
Mr R. C. Hesketh-Jones	- Hammersmith
Mr A. L. Cornford	- Harlow
Mr D. C. Smith	- Harlow
Mr I. G. Baxter	- Cricklewood
Mr J. C. Emery,	- Harlow
Mr J. Lavin	- Harlow
Mr J. H. A. Godwin	- Cricklewood
Mr J. A. Perham	- Canox
Mr A. R. Dow	- Canox
Mr J. D. Wordsworth	- Canox
Mr S. M. Taylor	- Harris) Summary + US visit except
Mr E. R. Savidge	- Harris) first page Section A.

DADM/Md'I. 10.6.69

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EQUIPMENT DIVISION

CONFIDENTIAL

VISIT TO NORTH AMERICA BY BUSINESS PLANNING MANAGER, MEDICAL/AVIATION

12 - 30 MAY 1969

SUMMARY OF CONCLUSIONS

1 Limited success of EOC's present business in USA while partly due to Harris' limited representation and coverage, is, to a large extent, due to the unsuitability and limitations of EOC product range for US market.

2 Given wider suitable product range, Harris' reluctance to expand could be overcome and much could be accomplished by this alone, even keeping close to EOC traditional product areas.

3 Regrettable lack of confidence in EOC exists both in Canox and Harris.

Impression of EOC is of outdated, cumbersome organisation which has little knowledge of or contact with US market. Poor supply position is the nagging toothache but there is strong feeling that EOC design and development takes no account of market requirements in USA.

4 Potential of EOC package ICU concept appears reasonable in Canada with Canox capability in supply of gases and pipeline installation. Vital however that actual market needs studied at first hand and not assumed to be as for UK.

Concept appears doubtful in USA. Reasons -

- absence of gas/pipeline facility in Harris operation
- strength of competitive suppliers of various component parts

However, individual products should be successful.

5 Inhalation therapy emerged as the most obvious and immediate profitable area for exploitation in North America by EOC. Enormous potential recognised by both Canox and Harris. Reflected in current policies, ie Canox striving to secure wider Bird agency; Harris to develop or factor sundry items for this market.

In Harlow Ventilator EOC have a promising product but pricing crucial. Also consideration must be given to system rather than isolated product.

BEST COPY AVAILABLE

6 Harris are well set to tackle field of anaesthesia and inhalation therapy given suitable product range. However, to make major impact over a wider field an acquisition of a US company with greater marketing strength is probably essential.

7 Laboratories were not visited as intended but clinique discussions with anaesthetists, nurses i/c ICU's and others indicated that staff and time in laboratories

8 Monitoring equipment. The field is peppered with electronic's companies but the simpler functions, particularly those of respiration, appear to have great potential. Development of Wright monitor and further derivatives a must. This view based on comments by Canon, Harris, Bird and anaesthetists and therapists.

9 Selling via dealers appears mandatory in equipment field.
Reasons - size of country
- insistence of hospitals on local supply facilities.

Exceptions only seem to be companies operating on a wider product field, eg gas company like OHIO or AMSCO with high value capital goods requiring negotiations with architects etc. Yet even OHIO make use of dealers in some areas.

10 Cyprane business in vaporisers flourishing in States. Generally preferred to indigenous product. Harris would be excellently suited to market. Other Fraser-Sweatman products (with possible exception of vaporiser) not of interest.

11 Good delivery is vital in USA. UK firms reputation is poor in this respect - Portex, MIE, BOC. US hospitals run as businesses have no hesitation in throwing out suppliers for poor deliveries.

12 Disposables. In respiratory field, still not really gaining, but general opinion is that an eventual swing to disposables is inevitable. UK firms still dominate both rubber and plastic tube market.

13 NCG as possible marketing ally in medical field not recommended. Canox report they are gas oriented and not really interested in equipment. Harris view is similar and Fraser-Sweatman/NCG alliance was apparently unsuccessful.

RECOMMENDATIONS

If BOC to recapture leadership and exploit opportunities in North America, the following are essential:

1 Closer appreciation of the market by both marketing and development personnel. Visits of a few days or weeks not the answer. Semi-permanent attachment would be a step in the right direction.

Development of the right products by personnel based at Crickleswood or Harlow is doubtful.

2 Evidence of BOC's determination to right its shortcomings, ie better deliveries, rectification of product faults.

3 A willingness to seize opportunities that arise in USA for new products, eg Teledyne oxygen analyser.

4 Generally recognise in development, marketing and general organisation that the North American market is worthwhile in its own right and is not just another outlet for products basically designed for the UK.

Specific fields which should be given priority attention are:

Inhalation therapy - development of complete range, eg stands, compressors, oxygen monitor, mixing valves.

Lung function test equipment, ie completion of the Wright monitor and its further derivatives.

Long term volume-cycled ventilator.

A 3928

VISIT TO CANADA 13 - 17 MAY 1969

A. DISCUSSIONS WITH CANOX PERSONNEL

Mr Allen Perham
Mr A. Ray Dow
Mr Jack Wordsworth
Mr Guy Lalonde

1 Disheartening image of BOC held by all levels of management even down to representative level. Much of this stems from current problems with BOC supplies - see attached list.

2 Canox see BOC's development effort as unsatisfactory. Instanced particularly the Wright respiratory monitor. Prototype seen three years ago - still not available.

3 Lack of communication criticised. Canox do not receive up to date details of BOC development programme. Have in past given their views on product definition and requirements, but have little idea whether these are being incorporated or not.

Instanced: In February 1968 Canox gave requirements for pipeline outlets and secondary equipment. No feedback from BOC.

: Thoracic drainage equipment specification.

: Fail-safe requirements for Boyle

No positive action from BOC - (yet Harris have such a system).

Canox feel frustrated and isolated.

4 Canox see great potential in field of inhalation therapy. Therapists are becoming a recognised profession within hospital system. Due to State hospital system little development yet in specialised clinic (paying) or domiciliary field, but Canox are confident this will come.

Major concentration at present is on extension of Bird agency, which is highly profitable to Canox.

BOC Harlow Ventilator is viewed with mixed feelings. Reasons:

(i) Price suggested appears high.

(ii) Canox feel they have insufficient information as to Harlow's technical and clinical advantages.

(iii) They fear Bird reaction.

(iv) Harlow is felt to be single product compared to comprehensive system of Bird.

5 Canox showed interest in package concept for ICUs and feel the principle is sound. However, important that Canadian requirements are studied and not assumed to be as for UK.

6 Canox feel that their very success with English-style anaesthetic equipment has brought them to a point where new products are required if growth is to be maintained. It was interesting that this view was held even at representative level. Monitoring equipment was particularly mentioned as a possible diversification.

7 Expenditure in Canadian hospital services 70% plus labour and less than 6% equipment. Not known how this compares with other countries but obvious incentive for adoption of labour-saving devices.

B. CURRENT PROBLEMS OF CANOX WITH BOC

Canox complained that many of the points discussed with Mr D. C. Smith in December 1968 were still not rectified. The following are a summary of the most pressing. Number headings relate to Mr D. C. Smith's report dated 9.1.69.

4. Boyle Model 'M' still not received for evaluation.

5. 5½" sphygmomanometer still falls apart. Canox cannot understand delay on this point since only locking washers are required. I personally saw this fault with unit's insides adrift.

8. Wright respiratory monitor. Obviously still not received for evaluation but the point is that Canox did not know reason for delay.

12. Still have problems with outstanding orders for facemasks. Frustrated rumblings on subject of direct supply ex Warnes.

14. Still no information.

17. Still no reaction from BOC. This question first raised several years ago.

18. No samples of BOC suction equipment received and no reason for delay given.

21. Position still the same. The problem first raised in December 1966. I unpacked latest shipment of yokes - still plated. Also witnessed time wasting rectification of leaks that this involved.

22. No improvement here. I inspected latest shipment. Bags still wet in package on arrival. (Isn't a silica gel getter a possibility?).

23. Still no action. BOC have advised reasons but Canox appalled at delay which is seriously affecting their Soda-lime business.

24. Canox still not satisfied. Feel static in tube, not backplate. What action are BOC taking?

OTHER PROBLEMS

(i) Canox find it necessary to retest all regulators on arrival as several have been found at incorrect pressure setting.

(ii) BOC MkIII Absorber felt to be poorly designed giving many problems of maintenance. Also considered outdated. Canox query what stage BOC development has reached as they have been given no information.

(iii) Considerable difficulties with supplies of tubes. Instanced particularly 8mm streamlined tube. Orders only part fulfilled, eg 2,500 on order. Receipts only 500. This situation has been dragging on for several months - last supply was air-shipment of 38!

(iv) Quality control of facemasks criticised. Inside diameter of bush undersized. This coupled with poor anchorage of bush in mask mould results in detachment of bush when mask removed from fitting. (N.B. this complaint echoed by Harris, dealers and hospital staff). MIE anchorage of bush - and

A 3931

Warne's own mask - considered far superior to BOC. This complaint has arisen frequently over the past few years, but no improvements made.

C. VISIT TO NEW PREMISES OF FRASER-SWEATMAN, TORONTO.
16 MAY 1969

Premises.

Total area approximately 3,000 ft^2 consisting of reception area, warehouse, repair workshops and accounts department.

Staff

Three secretarial, six repair personnel, two salesmen and sales manager.

Sales

Fluotec population stated to be:

Canada	4,000 units
USA	12,000 units

Maintenance business:

Canada	150 units/month
USA	400 units/month

Standard overhaul and calibration charge £45 per unit with replacement of damaged parts extra.

Maintenance set up basically simple. Consists of compressed air leak testing rig, refractometer (Hilger & Watts) for calibration and fluothane recovery system.

Normal method is for Ayerst laboratories (ICI agent) to offer to pay for annual servicing in return for a hospital's fluothane business. FS thus have no debtor problem.

Fraser-Sweatman personnel reported increasing demands for their vaporisers - at present embarrassing due to restricted output from England. Stated all teething troubles with Mark III now solved and that calibration time (and costs) greatly reduced.

Impression reinforced that Sweatman's anaesthetic machines and absorbers are an expensive venture and that business largely reliant on range of vaporisers.

Anaesthetic equipment and absorbers are made at Sweatman's Lancaster, N.Y. factory but it was stated that consideration was being given to producing the absorber in UK.

Sweatman has produced an anaesthetic unit for veterinary purpose but this was relatively new and no reaction regarding its potential was expressed.

Sweatman in Canada have attempted to sell the Marco ECG unit but apparently with little success.

Fraser-Sweatman have apparently ceased their association with MCI in USA as this proved unsuccessful, and are now apparently again concentrating on dealers.

D. VISITS TO CANADIAN HOSPITALS

Wellesley Hospital, Toronto

Visit made principally to see ICU.

Layout 'L' shaped with services in angle. Definitely not planned on systems concept. Beds surrounded by variety of stands for monitors, intra-venous supplies etc. Nurse in charge Miss Compton felt that they were far removed from an ideal set-up, but at this stage flexibility was important.

Nursing staff were very enthusiastic about the range of monitoring equipment made in Canada by Harco Electronics Ltd., 740 Madison Street, Winnipeg 21, Manitoba. Stated they had tested several makes before choosing this range. Harco use an ingenious system whereby the electrode is glued to the patient and the lead is snapped on like a dress fastener. This method is apparently less prone to becoming detached.

Harco products might be of interest to BOC. They promised to send details of their range to Mr Lewsley. Also stated they were thinking of changing their UK agent.

A Canadian manufacturer like Harco could be more attractive from the import duty aspect than a US concern.

However it should be noted that Fraser-Sweatman have met with little success in factoring this range.

Nursing staff expressed wish for reliable blood pressure monitor.

This hospital has established inhalation therapy department.

Queen Elizabeth Hospital, Montreal

Visit again mainly concentrated on ICU.

Separate facilities for cardiac and other patients. Monitoring equipment in general unit mainly Tektronix portable EEC and ECG which were well spoken of. Also use Air Shield's blood pressure monitor which was, however, criticised for unreliability.

Cardiac unit used Electrodyne monitoring system with central console.

In both units some attempt to plan a system but this had obviously been outgrown, eg supply complex lacked compressed air, monitors in general unit were on stands at foot of bed.

Discussion with Miss Gillies, anaesthetist, indicated some reaction against electronic devices - no substitute for good nursing - periodic temperature taking etc ensured regular inspection of patient's condition and welfare. However, favourable reaction to any system giving better - less cluttered access to patient.

Bennett MAI ventilator preferred for long term work. Described as excellent machine.

CX.26.m

A 3934

E. QUEBEC HOSPITALS CONVENTION/EXHIBITION 14 MAY 1969

Exhibition was very wide in scope, ranging from drugs through food supplies to Hammond organs!

Major items of interest.

1. Sterilisation

Heavy emphasis on ethylene oxide sterilisation ranging from small units using Sparklets type bulb (3M, AMSCO) to large units complete with aerator running on a programmed cycle (AMSCO CASTLE) (Brochures attached).

2. Diagnostic Equipment

Several units displayed for bio-chemical analysis of specimens. All seemed to work on tintometer principle. LKB device developed in Denmark appeared popular. (leaflet attached)

3. Computing Respirometer

James Addison Potter, West Hartford, Connecticut had on display an interesting respirometer capable of measuring a wide range of functions. (leaflet attached) This seemed to be attracting considerable attention though rather crude in styling and appearance.

The high price such a unit commands (Respirometer £1,820, Recorder £1,255) is significant and augurs well for further development of the Wright Respiratory Monitor.

4. MIE Anaesthetic Machine

Mr Wordworth's opinion is that the latest Canadian MIE machine incorporating Harris regulators is ill constructed and clumsy and does not constitute a serious threat to the Boyle.

5. Monitoring Equipment

Surprisingly little monitoring equipment was displayed, but Hennen-Greatbach had an efficient looking set-up with telemetry. Mr Wordsworth has promised to forward descriptive literature

Competition

Spoke with Mr Alan Knight who is now with Air Liquide. AL have apparently deliberately decided to restrict their medical activities to the supply of gas, pipelines, outlets and associated equipment and to drop all other medical items. Linde appear to follow a similar policy.

There was a vague rumour that Narco would be willing to spin off Air Shields. Mr Wordsworth promised to report any further information that arises.

CX-26-71

A 3935

VISIT TO USA 18 - 29 MAY 1969

A. DISCUSSIONS WITH HARRIS CALORIFIC COMPANY

Mr Steve Taylor
Mr Gus Young
Mr Ernie Savidge

1. Present trading position of Harris Calorific.

Harris' current attitude to medical business is interesting. Originally they were attracted by the prospect of long run production of Boyle tables and other BOC equipment. They were rather disillusioned by the results and the small batch nature of the business. However, they are now quite reconciled to this and in Mr Taylor's words are "very glad we are in the medical business".

Their current trading picture makes this attitude very clear.

Four months to April 1969 (rounded off figures)

	£
Sales	250,000
Cost of sales	150,000
Contribution	100,000
Fixed costs	50,000
Net Profit	50,000

Provisional sales figure for May is in excess of £50,000 and a net profit of more than £100,000 is projected for the full year - a return on capital of some 40% pre-tax.

Harris are understandably reluctant to prejudice this excellent profit position for the sake of dubious growth and feel that with the present limited product range available to them, their policy of restraining fixed costs by selling via dealers is correct.

Harris' representation is at present one man on the West Coast, 'Skip' Mosher an energetic and extremely able salesman ex Liquid Carbonic.

On the East Coast Harris are re-engaging their former West Coast salesman. The Mid-West is at present being handled on an experimental basis via a manufacturer's representative, and Mr Savidge plans eventually to recruit another salesman based on Dallas.

Harris at present deal through some 110 dealers of varying quality, and feel they can now start some weeding out. The calibre of their best dealers is extremely high with good product knowledge and ability to carry out servicing.

Harris calculate the total cost of a salesman to be approximately £20,000 per annum and merely to maintain the existing level of profitability he would need to generate some £70,000 extra sales. Harris' claim that to guarantee this requires a greatly enlarged sales programme is hard to refute and the summary of the position vis à vis BOC products in Mr Savidge's letter to Mr Taylor of November 1968 is basically still accurate.

2. Harris' current view of BOC

Harris' view of BOC is regrettably very much akin to that of Canox but more so.

A summary of their current problems is attached but their major complaints are:

i) BOC have made little attempt to understand the US market and design products for it.

ii) BOC development appears to Harris practically non-existent.

iii) The supply problem shows little sign of improvement.

iv) Communications are poor. Harris are not kept in the picture on new product concepts or given the opportunity to comment.

v) Harris' innovations and suggestions are invariably turned down by BOC and decisions are slow.

On the question of a closer link with BOC, Mr Taylor stated he was willing to consider any suggestions. However, he stressed that capital was not the problem and what Harris are looking for is evidence of a firm intention by BOC to tackle the US market properly. The suggestion was made that BOC marketing and development personnel should be sent to USA on semi-permanent attachment to Harris to fully appreciate the market and its requirements (Mr Perham of Canox is also of this view).

3. Market Potential via Harris

There is no doubt in my mind that Harris have built up a valuable reputation in USA in the field of anaesthetic equipment. This is due to the energy of Mr Savidge. Even in areas where Harris had no established agent, (eg Salt Lake City) the name was known by the chief therapist and the anaesthetists knew Mr Savidge by reputation if not personally.

In hospitals visited in Los Angles, San Fransieco and Cleveland he was well known and highly respected, and this was also the attitude of other members of the medical equipment business to whom I spoke.

Harris medical is a small outfit but one which impresses with its enthusiasm and drive (the profit position was known down to assembly personnel who eagerly awaited the current month's figures).

There is no doubt that given the right product range Harris would be willing and able to greatly extend their scale of operation.

Unfortunately,(excluding Wright respirometers) the greater growth is from non-BOC products at present.

4. New Products, Areas

Harris see the field of inhalation therapy as the most promising area of immediate growth. Many of their dealers are already in this field and could provide a sound basis for the right product range.

Unfortunately, BOC therapy equipment (flowmeters etc) while excellently styled does not compare favourably in price to US made equipment (eg flowmeter nebuliser landed cost is approximately equal to selling price of comparable US product).

Harris reserve judgment on the Harlow Ventilator as at present apart from a brief sighting of this product, the information they have on it is restricted to a Sales leaflet. They cannot understand why they have not been given details of the technical and clinical advantages of this product so that they can start to evaluate it. They feel that to be told they may read about it in a medical journal in due course is not good enough.

Initial reaction is that price may be a problem. They also criticise the absence of essential ancillaries, eg stand, hose support, compressor, which are all available to competitors.

However, they recognise the urgent need for a major IPPB product with which to attack the field - their own effort being mainly concerned with sundries at present.

This market is already of staggering proportions in USA and yet repeatedly I was told that it is in its infancy. BOC should put highest priority on ensuring that it provides products suitable for this market.

It is doubtful whether the BOC 'package' ICU concept will be viable in USA. Main reasons are: -

- the greater strength of other suppliers of component equipment;
- the lack of gas/pipeline business to form the foundation of such an approach.

However, Harris feel that they could certainly market component parts of such a system, eg long-term ventilators and the long awaited respiratory monitor.

5. Harris, Mexico

Harris have a wholly-owned subsidiary in Mexico and at present have two dealers for medical products - MEDTEC (Bird distributor also) and AMSCO (newly appointed).

They have great hopes for sales of Boyle tables through AMSCO who are well entrenched in Mexico and feel that other BOC products could be sold via this dealer. They also feel that via AMSCO they could probably do a better supporting job than BOC with its existing dealer (Mr Pugh's recent report indicates BOC progress in Mexico has problems).

Harris however feel that supply ex USA of products other than Boyle would not be competitive because of US duty.

They propose therefore that BOC appoint Harris (Mexico) as agent supplying at same price as to existing agent. Harris (Mexico) would maintain stocks and supply Harris dealers, and Harris would provide necessary support.

I feel this suggestion is well worth consideration as BOC would maintain sales value of exports and leave problem of support to Harris

6. Acquisition Opportunities

Harris' view understandably rather restricted to existing medical field.

Disappointed that Puritan felt too expensive. Surprisingly mentioned OHIO may be possibility. (no real evidence of any Airco feelings in this matter however)

Still feel BOC should go for UK companies, eg rubber company (with plastic facility), Longworth, Cyprane Encouraged that BOC were actively investigating possibilities.

In US, said Harris were looking at :

Monaghan (make ventilators for OHIO and also rubber and plastics)

Anaesthesia Associates - Tom Rankin is very sick man and Harris attracted by range of fittings and sundries.

A 3939

B. CONGRESS OF ANAESTHESIOLOGY, SALT LAKE CITY, 19 - 22 MAY

1. Harris Calorific

The Harris stand was probably the best attended and appeared to have the most interesting new products of any among the anaesthetic equipment suppliers.

Boyle Machine

Undoubtedly now well-known and admired. Major problem is unfortunately the BOC MkIII absorber. Spontaneously criticised by many anaesthetists for clumsy method of assembly after filling, difficulty in rendering leak proof, painted finish, on-off lever.

Harris also criticised bi-metal (aluminium/brass) construction which apparently gives rise to corrosion and servicing problems. Harris find it necessary to offer Fraser-Sweatman as alternative.

Cape-Wain

Surprising interest in this unit. Four promising enquiries received. Criticised for its bulk and also inability to vary inspiratory/expiratory ratio, but simplicity and mechanical robustness is undoubtedly attractive.

(Harris have now sold 14 Capes in total)

Longworth Laryngoscope

New lightweight plated aluminium prototype enthusiastically received. This will undoubtedly be a big seller. Plastic version did not appear popular. Are BOC to sell aluminium version?

Teledyne Pocket Oxygen Monitor

Aroused great enthusiasm, particularly for inhalation therapy applications. Harris have had in stock only since March but by end April had sold 174. Harris feel this could be a winner for BOC also but are disappointed that BOC have only asked for literature to evaluate. Harris have to order in lots of 100 and feel that their offer to supply in batches of 10 to BOC is reasonable. (leaflet attached).

A larger prototype unit with high/low alarm settings, faster response (90% in 10 seconds) and greater accuracy, to sell in USA at £600 was also enthusiastically received.

There are probably several non-medical uses for these units and it seems well worthwhile for BOC to try them.

Swivel Tracheostomy Adaptor

A Harris designed product. Portex have already placed orders for own-brand version. Harris also hope BOC will place order. Again reaction was highly favourable at this exhibition and this unit should sell well.

Sheffield Infant Ventilator

A British product which Harris were exhibiting to evaluate. Interest disappointing, possibly due to high US selling price (£900).

A 3940

Reversed Wright Respirometer

Harris showed large dial Wright respirometer with movement reversed so that large hand measured individual breaths with cumulative reading on small hand. This involves replacing two standard parts with two other standard parts (see attached note for details) and was carried out by Harris in less than an hour. A new dial would, of course, be required. This unit received universal acclaim both on Harris' and Anaesthesia Associate's stand. Typical reaction "Why on earth wasn't this done before".

Sample unit brought with me.

Wright Shunt Valve

Considered an excellent product, many anaesthetists expressed intention to fit to their machines.

Neff Circulator

Considerable interest shown but difficult to evaluate as Dr Neff was a speaker plugging his invention. Harris query BOC's views and intentions for this item.

Williams Filters

Harris do very well with this item. Why are they not used in UK?

2. Dupaco

Main point of interest on this stand was wide range of lightweight fittings. Plating aluminium (and plastics) seems to be no problem in USA. Why don't BOC find out how they do it? Harris were surprised to learn we still had problems.

3. Anaesthesia Associates

Again plated fittings galore. Simple (and reputedly popular) absorber to take disposable packs. Recharging method very quick and easy. Harris queried what was happening to our re-design.

Tom Rankin bitterly criticised BOC face mask. Tight boss pulls out. Selling MIE in preference.

4. Portex

Little new. Portex having considerable supply problems (common criticism of all British manufacturers with exception of Longworth). US customers are impatient with outstanding deliveries and have no hesitation in switching suppliers for this reason.

5. Bird

Discussion with Bird indicated a need for good simple lung function test apparatus. Mentioned Collins as supplier who were moving from expensive special apparatus to simpler cheaper units with wide market. Bird feel this field is wide open at present.

Urgent development of the Wright monitor is again indicated.

A 3941

6. Ohio

Main attraction was EMOSS with electrically heated vaporiser unit. Mr Savidge feels the concept good. Ohio man naturally enthusiastic but agreed that maintenance and repair could be problem. Acceptance difficult to evaluate (leaflet attached).

7. Gregor, B. Rancz of Syracuse, N.Y.

Dr Rancz was a delegate to this conference. Mr Savidge feels he has several excellent ideas which could be of interest to BOC/Harris. These include: -

- A simple method of applying hyperthermia to a patient without moving him from operating table. Basically this is a ground sheet beneath the patient with the corners hooked up to IV. stands with ice then shovelled around him.

- A method for heating and humidifying anaesthetic gas stream.

- A tracheostomy adaptor able to swivel in all directions.

Mr Savidge will be meeting Dr Rancz in mid-June and will then get further details to pass on to BOC if of interest.

C. HARRIS PROBLEMS WITH BOC

1. Deterioration in quality of Wright Respirometers. They mentioned - incorrectly drilled centres; incorrect fit between pillar plates and bridges; interference to fit caused by chromium plating; badly set jewels.

   They feel deterioration set in approximately after model 6,000.

2. BOC face mask design. Detachment of bush due to tight internal fit and poor anchorage to mask.

3. Harris still have no new price list. Latest information was circular of February 1969. Harris not clear whether only items mentioned in this circular increased in price or are others affected too.

4. Little improvement in supply position. Instanced -

   - Murphy nasal tubes:

     Ordered January 15, 1969 100 x size 9
     " x size 9.5
     " x size 8

     These are still outstanding as are also bulk of order of January 15 for Murphy E/T tubes:

     70 x 6.5
     67 x 10.0

   - Face Masks:

     - Order of 15 January for various sizes

       150 x size 0
       300 x size 1

       still outstanding

       Only part supplies on other sizes, eg

       200 x 6
       250 x 2

       still outstanding

   - Rubber hooks for corrugated tubes ordered 29 July 1968 - 100 still outstanding.

   - Slow deliveries for Wright Respirometer parts are also complained of.

   - Rowbottom and Magill nozzles are outstanding from January 1969.

   - Wright Respirometers:

     Urgent order placed April 8 for

     100 immediate delivery
     100 by 1 May
     50 by 15 May

     None have been received only promised

     50 by end May
     50 by end June

     Even under best conditions Wright orders arrive two weeks after requested date.

5. Part Shipment

Improved but still not satisfactory. Harris suggest consolidating all supplies weekly. Consignments against several orders in one shipment would cause no problems.

6. Catalogues

Mr Savidge would like two copies of BCC UK catalogues and price list!

N.B. This is not an exhaustive list, but only the prime examples taken quickly from Harris' files.

CI-2C-W

D. HARRIS VIEWS ON DEVELOPMENT

Main view expressed was that BOC development often failed to appreciate needs of North American market. Slowness also criticised. Need for feed back stressed.

1. Anaesthetic and Long-term Ventilator

Harris encouraged that BOC tackling these products. Their suggested specification for these units is as follows:

A. Anaesthetic Ventilator:

1. Compact, must be able to fit within framework of Boyle's F, K and H.
2. Volume cycled from 50 MLS to 2000 MLS per stroke volume. (10 MLS to 2000 MLS if possible)
3. Pressure limited but adjustable to 100 CMS H_2O.
4. Manual operation circuit for normal "bag squeezing".
5. Variable inspiratory/expiratory ratios.
6. Stroke volume 10 - 75 Resp. per minute.
7. Patient assist mechanism.
8. "Closed" semi-closed and non-rebreathing circuits.
9. Electrically powered explosion-proof circuit. (If gas powered must be Nitrous Oxide or Carbon Dioxide)

B. Long -term :

1. Compact, must be able to fit within framework of Boyle's F, K and H.
2. Provision for programmed "Sigh" and deep breath attachment.
3. Variable resistance on patient's exhalation.

2. Absorber

Feel re-design overdue. Suggested requirements are:

1. Adjustable for use with ALL 1 or 2 standard US prepack cannisters.
2. Quick change "positive lock" Cannister change mechanism.
3. Cannister by-pass circuit with 'fail-safe'? (Positive lock device)
4. ALL brass or aluminium construction. Electrolessly nickel and/or chrome plated internally and externally. (N.B. no bi-metal construction)

3. Respiratory Monitor

Feel that this item of greatest importance.

4. Harris and other US Products

Low oxygen warning whistle: Developed by Harris. Saw initial unit on test, appears simple and effective. Is not this worth looking at?

CX·26·X

A 3945

Disposable Rubber tube: Harris gave me leaflet and sample of disposable rubber tube made by United States Extruded Vinyl Products, Inc. Do we know of this? Is it of value? Harris have asked whether USEVP can produce in conductive form.

Swivel tracheostomy mount: Harris about to get first production items. Suggest we evaluate quickly. Portex have already ordered.

Disposable Breathing Set and Absorber: This is being marketed complete by Will Ross at £15. Seen in hospitals but conventional absorber still in use. Reaction seems to be interested but not yet convinced.

Air Oxygen Mixing devices: Variable proportional mixer air/oxygen for use with IPPB machines. Selling price USA £350. Manufactured by Variflo 250 Canal Blvd., Richmond, California (makers of Bird equipment).

E. VISIT TO HOSPITALS

1. University Hospital, Salt Lake City

Visited Inhalation Therapy department. Hospital of 300 beds with 30 - 40 patients usually receiving respiratory treatment. Two-thirds of these are on IPPB machines.

Staff of department totalled 10 of which 7 were qualified to give treatment. All were trained to maintain and repair equipment - mainly Bird, some Bennett.

Chief Therapist insistent that this hospital ill-provided for in comparison with the best. Saw development of out-patient treatment and domiciliary treatment as inevitable and overdue.

Hospital authority more favourably inclined to inhalation therapy now that it was clear this was a profitable service, (this comment repeated in other hospitals) but danger of over-playing this aspect well recognised.

Main constraint is staff. Stressed average nurse often bewildered by apparent complexity of Bird machine. Agreed that simplicity of operation was a vital aspect of IPPB ventilator.

Bennett MAI used for post-operative work. Considered good but expensive and beyond scope of her staff for all but simple maintenance.

Great stress laid on importance to hospital of local dealer for provision of sundry equipment - masks, adaptors etc.

Harris name known. BOC never heard of.

2. University Hospital, San Francisco

Chief Therapist interviewed.

650 beds, of which 15% of patients served by Inhalation Therapy department. Over half of these receiving IPPB treatment. The hospital has some 60 Bird Mk7 machines in use, plus a few Bennett, and the inhalation therapy staff total 17.

Revenue from department in this hospital is $300,000 per annum.

Again stated that inhalation therapy was in its infancy and that this hospital compared poorly with others on the East Coast.

Bird machines preferred because -

- inspiration time variable
- easily serviced
- excellent service back-up from local dealer Allied Therapy.

Saw big increase in out patient and domiciliary field. Felt major gap in IPPB range was for quiet dependable compressor for use in home. Did not like Bird compressor - considered it noisy.

Felt volume cycled units for long-term use more advanced in Europe than USA. Had Engstom on trial but considered it ill-designed, dangerous? and expensive.

Knew of Cape but criticised inability to vary inspiratory/expiratory ratio.

ICU visited briefly. Well planned with monitoring units racked on wall. No central console. Units were by Electronics for Medicine - well liked and reliable. Bennett MAI in use - new, no definite views.

3. UCLA Hospital, Los Angeles

Interviewed Dr Cohen. Professor of Anaesthesia. Visited operating theatres. Variety of equipment in use including early model Harris Boyle.

Harsh criticism of some features - most of which Harris newer models have obviated but are still on BOC unit.

Condemned as dangerous the switching device from closed to open circuit, the lack of a lock on the emergency oxygen button, on/off switch on absorber (taped up) and the MkIII absorber itself - problem with leaks.

Not certain how typical Cohen's views are - he is an obvious indvidualist.

Analysis of blood and its gas content made on instruments supplied by Instrument Laboratories, Boston. Still apparently a highly skilled job to operate this equipment however.

An interesting development seen in this hospital was a complete anaesthetic console containing, monitor, gas machine, ventilator, suction etc.

Dr Cohen enthused about this development saying it pointed the way to the future. This may be so but it was interesting that in this theatre an operation was taking place using a separate anaesthetic machine!

The console was specially built by Dupaco to Dr Cohen's specification (Dupaco seem a favourite of his) and Dr Cohen stated they already had found that the original design was not ideal. A MkII was planned, as modification of the original was not feasible. This seems to indicate the need for a truly modular concept rather than an impressive but inflexible console such as this original model.

4. Cleveland Clinic

Interviewed Dr D. Hillsman.

Pulmonary Function department. Variety of specially built equipment for carrying out analyses of respiratory funtion. Main supplier Instrument Laboratories, Boston.

Dr. Hillsman has designed and built a recording spirometer with adjustable alarm devices for monitoring patients. The equipment is at present large and cumbercome but apparently effective. It uses bellows to measure volume breathed. Could the Wright principle be an alternative? Is recording desirable?

ICU visited. Interesting in that part of it was designed to cope with respiratory patients. Unusual feature was that these beds are reversed with patients' feet to wall with gas and other services taken from ceiling column at outer end of bed. Idea that it is the head end of patient that is of interest and is most conveniently got at this way.

However, nurses the problem; this arrangement offends their sense of tidiness and to Dr. Hillsman's despair they put patients in beds the normal way round.

An interesting point made by Dr Hillsman was the importance of maintaining wearing parts in machines like ventilators. He suggested som form of counter to be incorporated that would measure the number of cycles performed so that bellows etc could be replaced at the recommended intervals.

A 3949

F. ALLIED THERAPY, TOLMAN STREET, SAN FRANCISCO.

Allied Therapy are Harris dealers with throughput of some £4,000 month after a little more than a year's operation.

While anaesthetic equipment is relatively new to them, they are well established in the field of inhalation therapy and are Bird agents in Northern California. In addition to the San Francisco premises, they have a branch at Sacramento.

The business is owned by a husband/wife team. Mr Lavergotte an ex baseball star is the president but his wife Mrs Mary Lavergotte is the driving force. She is a registered nurse and is dedicated to inhalation therapy.

Her success in this field is remarkable. She has a warehouse of some 1500 ft² packed with Bird and other equipment. Sales of Bird ventilators run at approximately 550 per annum and they have currently an additional 5,000 ventilators on hire. Again, however, she stressed this field was in its infancy.

They have six representatives all of whom are trained therapists, plus two teaching therapists.

Mrs Lavergotte attributes here success to a through study of respiratory problems and the techniques of IPPB treatment.

She operates fortnightly training seminars (free) for patients on both Bird and other machines and also administers IPPB treatment at the request of local doctors.

Allied Therapy would be an ideal outlet for DOC products in the therapy field.

Mrs Lavergotte is keenly conscious of the necessity of simplicity of operation and was very interested in the description of the Harlow and its advantages (as far as I knew then).

Mrs Lavergotte is due to visit Europe in August and is most eager to visit DOC. To enable her to claim taxation allowance for her visit she requires an invitation from DOC. I assured her this would be forthcoming (would Mr Cornford please write).

I feel the main advantage to be drawn from her visit would be:

1. To make every attempt to sell her on the Harlow - discussions with Professor Robinson might be a good idea. Once sold she could really get things moving for us in USA.

2. To learn from her experience in building up a thriving business in inhalation therapy.

3. To impress on her the full value of DOC's anaesthetic equipment business.

During her visit she also will be visiting Scandinavia and Germany (Drüger)

G. VARIFLO, 250 Canal Bvd., Richmond, California

This concern (subsidiary of National Welding) manufacture Bird equipment. At present they purchase face masks from NIE but are dissatisfied with supply position. (deliveries of Birds are delayed due to lack of face masks)

Annual requirements are 27,000 masks, made up as follows:

	NIE Sizes
1,500	No.1
2,500	2
3,000	4
18,000	3
2,000	0

Harris are of course eager to supply and Variflo ready to order if attractive quotation and delivery are forthcoming. Harris are sure they can give price equal or better than NIE but in view of past delivery problems with BOC feel that supply is the snag. Variflo could give three month lead in time. Can BOC guarantee supplies?

CX-27-A

A 3951

D. W. E. Stafferton - Cricklewood — 29 April 1969

Mr J. A. Perham - CANOX — CONFIDENTIAL

cc: Mr R. C. Hesketh-Jones
Mr D. A. D. Morgan

I enclose a copy of a letter to Steve Taylor which is self-explanatory, as well as David Morgan's notes on his objectives during this trip. He will not, of course, discuss his notes in detail with Harris, but would appreciate the opportunity to do so with you and you may of course be able to help him in making contact with some of the companies on his list.

I do not necessarily expect him to produce firm conclusions from this visit but his investigations should help in the three directions which I mention in my letter to Steve Taylor. We are impressed by the size of the US market and by the amount of development expenditure going on at the moment in medical fields related to ours. The American market is also faster moving because it is less tied to government expenditure decisions than in UK. For these reasons we need to know what is going on and we should keep up with development in USA by close involvement. The British lead in anaesthesia seems to me to have virtually finished and we cannot rely solely on our knowledge of the UK market in future when we depend for adequate profit on substantial sales throughout the rest of the world.

Harris is not ideally suited for the job of medical distribution which they are undertaking now and we should look at the possibility of making an acquisition. The first two criteria as I see it are that any company which we buy should a) be big enough to make a good impact on the US market with our present medical products and b) have a product range which is complementary to our own.

You will notice a reference to Fraser-Sweatman and Cyprane in the notes. We have come to the conclusion that we are unlikely to be able to develop a vaporizer which is superior to the Cyprane range and, consequently, are thinking of acquisition, either of Cyprane or of another company in this country with suitable equipment. I do not know whether Fraser-Sweatman would want to sell. If he does he may want to sell his interest in Canada as well as those in UK. We do not know whether they would be of any advantage to us and your views would be welcome.

As things are planned at the moment, David Morgan will be going to Cleveland first and, when he has learned sufficient from his visits with

over/

Harris, would like to talk to you about the rest of his trip. He will therefore be getting in touch with you direct. Morgan Chris Hesketh-Jones suggested that it would be useful if he talked to you and Al Muller together at some time during the trip.

I hope that this exercise will turn up something useful and if it does we should meet again fairly soon.

With best wishes,

GUIDELINES FOR BOC GROUP ACTIVITIES

in

NORTH AMERICA

The following guidelines are not intended to be restrictive nor all-inclusive, but are considered a first effort at a reasoned approach to our aspirations for North America.

Objective

To seek, assess and recommend profitable business opportunities in the area. Such opportunities should be mainly acquisitions, but will include joint ventures and may include licensing arrangements.

Area

North America shall mean Canada, the United States of America including Puerto Rico and Mexico. This excludes at this stage the Caribbean area and Central America.

Responsibility

J. A. Perham, with the assistance of Dr. A. Muller, will be responsible for negotiations within the intent of this objective within the area defined. This is not intended to restrict or prevent the normal flow of existing business or technical exchange. But it is intended to emphasize the need for full communication of activities in the area.

GUIDELINES FOR BOC GROUP ACTIVITIES IN NORTH AMERICA

Communications

Anything which may be a business opportunity shall be a communication between J. A. Perham in Toronto and R. C. Hesketh-Jones in London.

Matters of a purely technical nature will be handled by Dr. A. Muller with the BOC personnel concerned. But where technical development may offer a business opportunity, Dr. Muller will keep J. A. Perham advised.

Communications with other BOC executives regarding business opportunities will be the responsibility of R. C. Hesketh-Jones.

Acquisitions

At this stage the assumption is that a controlling interest in a profitable business will have first priority. A minority interest is not excluded.

The following factors are guidelines to assist in preliminary screening prior to any negotiations in depth and are divided in importance, between significant and desirable.

GUIDELINES FOR BOC GROUP ACTIVITIES IN NORTH AMERICA

A. Significant Factors

1. Willingness to Act

Time should not be spent on research or negotiations with any company unless there is early indication of a willingness to make a deal.

2. Management Interest

This is an intangible, but unless the BOC management group have a real interest in the product, markets and industry in general, and are prepared to act promptly, there is little likelihood of a successful negotiation.

3. Organization

It is assumed that most opportunities will arise in closely held companies where the proprietors desire liquidity for estate tax purposes, perhaps due to aging management. There may likely be a need for additional working capital. Top management may be weak or tired. While this is to be expected, definite evidence of a strong marketing organization is an essential -- especially in the USA.

4. Product Line

The product line should be the same or complimentary to our existing products in distribution, manufacturing or technical development so that a sound business judgment can be made of the opportunity.

GUIDELINES FOR BOC GROUP ACTIVITIES IN NORTH AMERICA

5. Earnings Growth Record

There should be demonstrated earnings in order to provide a basis for future projection.

6. Reasonable Down-Side Protection

A feast or famine situation should be avoided as should an industry which is obviously oversupplied.

B. Desirable Factors

1. Sales Volume

In order not to dilute our efforts on a series of small situations or investigations beyond our financial ability, the minimum sales volume will be $1-million and the maximum will be $50-million. The desirable area will be $5-million to $20-million.

2. 10% Before Tax on Original Investment

While this is less than BOC group objectives, it is probably realistic for reasonable opportunities in America.

3. Distribution

BOC can most likely provide technical, production or financial guidance, but lacks experience in the USA distribution. It is highly desirable that this competence be present in the prospective acquisition.

GUIDELINES FOR BOC GROUP ACTIVITIES IN NORTH AMERICA

4. Technology

Similarity of technology is not as important as management interest which assumes an understanding, appreciation or willingness to enter a somewhat different field. However, similar technology will be a definite advantage.

This list of factors is merely a working document to be refined as necessary and to provide a very preliminary screen before considering price and terms, working capital, tax and legal implications, etc.

There is a need to be able to move rapidly on a potentially attractive acquisition. There are generally many potential buyers for any business likely to interest us. It is important that we are fully aware of the avenues and vehicles available to BOC along the acquisition route. Competent legal and financial advisors will be found so that our approach to a situation will be an effort to agree terms early in the negotiations, subject to confirmation of all essential facts prior to contractual agreement.

Authority

No agreements will be authorized without the written consent of the Group Managing Director.

J. A. Perham
A. Muller
May 14, 1969

CX-31-A

Still Hollow Road
R. D. 2
Lebanon, N. J. 08833
U.S.A.
June 25, 1969

Mr. L. E. Smith
The British Oxygen Company Limited
Hammersmith House
London, W.6
England

Dear Leslie:

My principal activities during the past month are listed below:

1. Attendance at the National Bureau of Standards symposium on electron, ion and laser beam technology. This relates to a request from Edwards for information on ion beam implantation methods and developments in the U. S.

2. Meetings with W. A. Smith and R. Robinson in New York, and jointly with them and Dr. S. Weinig of Materials Research Corporation, regarding further collaboration with MRC. It was not possible to make the proper "deal" with MRC and further discussions have been terminated for an indefinite period.

3. A further discussion and visit to American Sterilizer to ascertain their continued interest in acquisition by BOC. At this time I learned that there is a sharp difference of opinion in their top management with respect to this subject, and that until this is resolved, there is little that can be done on our part to carry the matter further.

4. Further discussion with J. A. Perham and R. Stevens (attorney) regarding alternative methods of financing major acquisitions in the U. S. and the further development of guidelines and strategy for the establishment of BOC in the U. S. market.

5. A meeting and further discussion with R. Hart of Hart Metals with respect to his continued interest in marketing certain Murex products in the U. S. Hart met with J. Williams in London on this subject some months ago, but at that time nothing positive resulted from the discussion. He is still interested and would like to hear further from BOC on this subject.

During the past month I have completed my relocation to the above address and by a copy of this letter to C. Hesketh-Jones am requesting that all communications and contacts be referred to the above address effective immediately. My new telephone number is 201-230-6461. I am in process of establishing an office in a separate building at my new residence which will improve operations significantly.

Invoices for my June consulting fee and expenses for the period May 16-June 15, inclusive, are attached.

With best regards.

Very sincerely yours,

Albert Muller

AM:kcc
Enclosures

CC: Mr. C. Hesketh-Jones
Mr. J. A. Perham

CANOX

A 3960

Seagrist - Welch?

" any information yet?

July 8, 1969

Mr. Kevin J. Bradley
Senior Vice President
Dean Witter & Co. Incorporated
14 Wall Street
New York, N. Y. 10005

Dear Kevin:

I have been advised by BOC not to make any approach to George Dillon or to let Dillon have any hint we have talked to anyone about Airco. I have assured BOC that you did not reveal our possible interest. If there is any change in the future I will let you know.

Sincerely,

J. A. Perham
President

JAP/P

cc: Richard de La Chapelle

Dn Purcell
FTC
Bureau of Competition

425 13 St NW
Wash, DC
20580.

CANADIAN OXYGEN LIMITED
Manufacturers of compressed gases
Welding supplies • Medical equipment
Executive offices • 355 Horner Avenue, Toronto 14, Ontario, Canada • Telephone • 251-5241 • Cables • Canoxgen, Toronto

A 3961

CX-35-A

Still Hollow Road
R. D. 2
Lebanon, N. J. 08833
U.S.A.
July 24, 1969

Mr. L. E. Smith
The British Oxygen Company Limited
Hammersmith House
London, W.6
England

Dear Leslie:

My principal activities during the current reporting period are listed below:

1. Two trips to Toronto for discussions with J. A. Perham regarding active proposition for BOC activity in North America. There are currently a half dozen of these situations, not including those on which decisions have been taken not to proceed.

2. Follow-on visits with the financial community in New York with respect to various approaches that can be used by BOC to acquire businesses in the U.S. Discussions were held with Dean Witter, Kidder Peabody and the Chase Bank on the subject without obligation to BOC. This information has been reported to Mr. Perham.

3. Assistance has been given Edwards in the recruitment program for a new general manager at Grand Island. Several personal contacts were made in New York, Philadelphia and Pittsburgh in this connection, from which one man has been interviewed by

Mr. Unstead. Arrangements have been set up for the retention of Paul Stafford Associates, Ltd. for further recruitment if this proves necessary.

4. Some time has been spent assembling data on the U.S. hydrogen market at the request of Mr. Greenfield. This information is being assembled and will be forwarded as soon as possible.

5. Additional visits and discussions have been held with Unibraze Corporation (J. Robinson) and Cutler-Federal regarding acquisition by BOC. Financial data, and so forth, on these organizations have been given Mr. Perham.

Invoices for my expenses for the period June 16-July 15, inclusive, and my consulting fee for the month of July are attached.

With best regards.

Very sincerely yours,

Albert Muller

AMikcc
Enclosures

CC: Mr. C. Hesketh-Jones
Mr. J. A. Perham

A 3963

CX-35-C

July 24, 1969

TO: The British Oxygen Company, Ltd.
Hammersmith House
London, W.6
England

FROM: Albert Muller
Still Hollow Road
R. D. 2
Lebanon, N. J. 08833
U.S.A.

Expenses For The Period June 16-July 15 Inclusive:

Travel	$ 627.28
Telephone and Communications	83.40
Part-time Secretarial Service	179.64
Miscellaneous Office Supplies	32.96
TOTAL	$ 923.28

Albert Muller

A 3964

CX-35-D

July 24, 1969

TO: The British Oxygen Company, Ltd.
Hammersmith House
London, W.6
England

FROM: Albert Muller
Still Hollow Road
R. D. 2
Lebanon, N. J. 08833
U.S.A.

Consulting Services:

July, 1969.....$ 2,750.00

Albert Muller

AMukcc

CX-36-A

Form No. 528

BOC A 3965

From Group Managing Director

Date 18 August 1969

To Managing Directors
Chief Executives
Mr J.A. Perham
Mr H.S. Rich

LES/ES

R. C. H-J
9 AUG 1969

Copy - Mr R.C. Hesketh-Jones
Deputy CE Overseas

NORTH AMERICA

As part of its declared policy to become more truly international, BOC seeks profitable opportunity to extend its operations in the world's most important and advanced market - North America.

In order to enable more attention to be devoted to the co-ordinated search for such opportunity, it has been decided that Mr J.A. Perham, President, CANOX, will assume responsibility for progressing all such activity. So that Mr Perham can devote the necessary time to this, Mr A.R.Dow has been appointed Executive Vice-President, CANOX, thus relieving Mr Perham of day-to-day management responsibility for CANOX operations. Mr Perham will be assisted in his new responsibilities by Dr A. Muller.

North America in this context means USA (including Puerto Rico), Canada and Mexico.

At present, our activities in this territory extend from exporting, through licensing, to substantial investment 100% owned or otherwise in operating companies. In all these activities, the relevant UK trading divisions will continue to be vitally interested.

Exporting from the UK to the territory will continue to be exclusively the responsibility of UK trading divisions. Mr Perham's search for opportunity will be concerned with acquisitions, joint ventures, and possibly licensing arrangements. In following these up, he will usually be involving the interests of one or more UK trading divisions, and it will thus be necessary to ensure smooth and speedy communications throughout. The focal point in London of all communication on this subject will be CE Overseas, who will be responsible for:

(a) keeping all parties informed in the UK,

(b) advising on the appropriate time for any direct intervention by a BOC Managing Director or Chief Executive.

(c) obtaining all necessary clearances in the UK at various stages of investigation/negotiation and seeing that these are transmitted promptly to Mr Perham.

Mr Perham will advise and consult with Mr Hesketh-Jones on all proposals which appear to hold promise. Mr Perham should be consulted immediately whenever any investment opportunity is identified by a UK trading division and action taken only in co-ordination with him. This should normally be done after prior consultation with Mr Hesketh-Jones and in all cases copies of all correspondence to Mr Perham should go to Mr Hesketh-Jones.

In all this, prompt and full transmission of information is essential. In more routine matters, satisfactory communication is also necessary to avoid possible misunderstandings. For example, BOC Group personnel are frequently in the USA and many departments are in correspondence with USA companies. Similarly, visits by Export personnel are regularly made to Mexico and USA and reports produced. Trends in export performance from some divisions may be significant to Mr Perham as background data. He should be kept advised on visits, important correspondence and relevant export statistics. In order to ensure this without needless copies of correspondence, reports and papers being sent to Toronto, Overseas Division will assume responsibility for keeping Mr Perham posted with relevant information. Separate instructions will be issued shortly by Overseas Division on how this is to be achieved.

(Group Managing Director)

BOC Ex 37A

A 3967 August 26, 1969

President - Canox
Mr. J. A. Perham

USA

Head of Planning Secretariat - BOC
Mr. H. S. Rich

cc: Mr. R. C. Hesketh-Jones

Dear Harold:

I think you have prepared an excellent discussion paper on the problems of business development in the USA. There is very little in the draft which I would question.

It could be that you are placing too strong an emphasis on size. If we consider the possibility of taking a minority position in an already thriving business, it really boils down to how much dollar investment we may be capable of making. For example, Liquid Air, we believe, are prepared to take the plunge for $100-million. Perhaps BOC's maximum may be, say, $50-million. If it could be closer to $100-million then, of course, there are many more opportunities. This was confirmed in my discussions with the Dean Witter people in New York. For example, it might be possible to take a minority holding in American Hospital Supplies, or in Hobart Brothers Inc. Or it might even open the possibility of buying the industrial gas division of Airco.

You are quite correct that small companies with a growth record that would attract us have in the recent past experienced very high P/E ratios. I am inclined to feel that our most likely avenue, and perhaps most rewarding, will be in joint venture. But once again, I wouldn't overemphasize the much smaller aspect.

I certainly agree with you that Canada is not a base for penetration of the USA market. The best it can do is provide a home for the period in which we are conducting our search.

BEST COPY AVAILABLE

August 26, 1969

Mr. J. A. Perham

USA

Mr. H. S. Rich

The choice of sectors that should have priority, as you have indicated, may call for revision later. I think your first item, medical hardware, should clearly indicate the possibility of disposable hospital supplies. You have the Predicast Industry Study No. H-1 on this subject. If American Hospital Supplies is too big for us to manage, there may be the possibility of C. R. Bard for whom we have a high regard.

I agree with distribution of industrial goods as being high on the list. But this might well embrace a company devoted to welding specialties such as Eutectic or Unibraze Corporation.

I think I would rank in third place either or both cryogenic firms and vacuum companies.

In fourth place I would suggest a hard look at companies in either electric or gas welding fields. For example, as you have suggested, what could further be done with Harris Calorific, or with the acquisition of Smith equipment and adding it to Harris, or in the electric welding field an alliance with Hobart Brothers Inc.

I think we have to make up our mind whether we want to be in chemicals or not. I am afraid that even specialty chemicals may prove to be highly capital intensive.

I would be inclined to rule out food services entirely, but here I am open to suggestions. This is an already well-developed field and I am afraid would be more than we are able to handle.

CX-37-C

4 3969 August 26, 1969

Mr. J. A. Perham

USA

Mr. H. S. Rich

- 3 -

I would add one final category which I might call "new business." It is possible that a good opportunity may exist in a business we have never considered. For example, Cutler-Federal Inc. It is a possibility. Their specialty is air chutes for the transportation of products in manufacturing, food processing, medical services, etc., etc. They are better known for the now old-fashioned tube system used for transporting bills of sale and money in department stores. They claim to have now redeveloped the product so that its future application will lie in laboratory, medical and research applications where non-contaminated environment must be maintained.

Here in Canada we will probably be acquiring the J. A. Tumbler Laboratories Ltd. which, among other things, manufactures plastic body filler for the automotive trade. If this proves successful there might be a case for a similar step in the USA.

I am very pleased to see that this subject may be placed on the agenda for BOCI. Some of the comments I have given you I will, of course, be prepared to raise at the meeting so that, if you like, I am willing to accept your draft as it is. This may save some time for you by not having to incorporate the comments I have offered.

Sincerely,

JAP/P

A 3970

BOC

CONFIDENTIAL

date 22nd August 1969

our ref CX-38-A

your ref

from H.S.Rich

to Mr J.A. Perham, CANOX

Copies to: Mr L.E.Smith
Mr R.C.Hesketh-Jones
Dr D. Melvin

U S A

The attached draft sets out some thoughts, from a Group Planning point of view, on the problems of business development in the USA. The idea is that the draft would be basis for a paper to be issued in readiness for BCCI next month, where there would be discussion.

Mr Smith asked me to send you the draft and to seek your comments; whether, and in just what form, we proceed with the paper will depend largely on your views. I would appreciate very much hearing from you. If we are to issue a version for BCCI then it ought to be ready about mid-September.

There are certain parallels between the USA problem and the Group's European problems, so I am sending a copy to Dr Melvin.

Yours sincerely,
Harold

H.S.Rich

Form 528

A 3971

CONFIDENTIAL

DRAFT

20th August, 1969

CX-38-B

BOC AND THE USA - A PAPER FOR DISCUSSION

1 Incentives and Obstacles

2 A Possible Policy

3 Canada as a Base?

4 Choice of Industrial Sectors

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Draft

20th August, 1969

CX-38-c

BOC AND THE USA - A PAPER FOR DISCUSSION

1 Incentives and Obstacles

The Group's participation in businesses in USA is very small. EHV Inc. is the only wholly-owned operation. Reasons for aiming at substantial extension :-

(1) The USA is the largest, most advanced and most highly productive industrial area in the world with its Gross National Product (GNP) some 8 times that of the UK and 2½ times the total of the six EEC member countries. GNP per head at $4,280 is the highest of any large country. Most industries in which technology ranks as "advanced" are dominated internationally by American firms. Output per employee in the American engineering industries is twice to three times as high as in other advanced industrial countries.

(2) There must be competition with American-based international corporations on their home ground, at least in certain selected businesses, if the Group is to be confident of survival internationally against American-based firms. The Group must have some direct exposure to the American industrial and technical climate.

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(3) German firms are likely, increasingly, to invest heavily in the USA over the next few years; this export of capital will be a reflection of German trade surplus. BOC could be at some world-wide disadvantage against (eg) Linde AG, Messer-Griesheim and Draeger if they are extending into the USA and BOC is not. L'Air Liquide, despite the adverse French balance of payments, are already expanding in the USA.

Nevertheless, the difficulties will be great :-

(4) Political and nationalistic considerations give the local firm an advantage. The BOC Group's first phase of participation must be seen as something that can only hope to succeed in a small or specialised sector - one that is changing fast so that there is opportunity for newcomers. It is unlikely that an effective strategy could be built around an objective of becoming a major American firm in any wide range of gases and welding products; although possibility of participation in limited sectors need not be excluded at this early stage of reviewing the problem.

(5) There is a problem of finding dollar finance, which Central Finance is studying separately. Moreover it is unlikely that a proposition would be found which, from the outset, would meet BOC's normal requirements for return on new investment.

(6) Entry by direct venture, with virtually no existing base from which to build, is unlikely to be practicable.

(7) Entry by acquisition would be difficult; financial justification would not be easy since the P/E ratios of successful small companies can be as high as 30 or more. Average P/E ratios, however, differ little from the UK and there is just the possibility that BOC could find a depressed company to which it would be offering a life-belt. More generally, American firms are usually unwilling to be acquired by non-American owners; EHVI has made attempts to secure a broader base in USA and its experience supports this point.

2 A Possible Policy

Despite the very large size of markets in the USA, the main purpose of a series of BOC ventures over the next, say, five to ten years would be commercial, managerial and technical "exposure" rather than for the sake of the business itself. Some kind of joint venture, or series of joint ventures, could give "exposure" if direct entry and acquisition are blocked. The way into the USA for the BOC Group might be by some form of association with an existing firm which would have a specification broadly like this :-

a much smaller than BOC; but growing fast enough to be aware of the needs for "big company" strengths that BOC could bring through an association.

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b successfully participating in some business within the definition of BOC's existing and intended corporate strategies. A business in which the American environment gives some distinct, identified, advantage that BOC can tap for exploitation in the UK, Europe and elsewhere.

c no operations on any substantial scale outside the USA, so that BOC could immediately give the advantage of international access.

d not capital intensive and not a business in which it is intrinsically disadvantageous to be small, at least initially.

BOC's association would probably have to begin on the basis of a 50% or even a minority shareholding, because it is unlikely that the management of a company worth buying into would let BOC have a majority position, and BOC could not expect to win control of an American quoted company in face of opposition from its Board. Nevertheless, the long term intention would be a majority position - to be won by making a visibly dominant contribution over a period of years to the venture's success, and by meticulous attention to cordial and constructive relationships. The partner would come to have a sense of achieving things with BOC that he could not achieve alone; in time he would see himself as a member of the Group.

An added incentive both for BOC and the partner might be the possibility to manufacture outside the USA some labour-intensive article at present made only in the USA, and so obtain the benefits of lower labour costs. Or there may be cases where there are advantages in building up an international product development team to work in UK or Europe, but aiming at the USA and world-wide markets. There would have to be the closest evaluation, however; in some instances the American labour cost disadvantages will be offset by scale and other factors.

3 Canada as a Base?

A question that might be asked is whether Canox might not serve adequately as base for expansion into the USA or indeed whether growth in Canada could be seen as a satisfactory substitute. The Canadian GNP is one-fourteenth of that of the USA. Canadian GNP per head at $2,920 is some 68% of the USA figure and it is arguable that it is as high as this only because of geographical contiguity. Thus, while Canox has an important and valuable place as base for the BOC Group in North America, its existence and its further development cannot be seen as substitute for Group business development policies for the USA.

4 Choice of Industrial Sectors

What industrial sectors should be seen as having priority for study as the way into the USA for BOC? Following is suggested as a first list :-

CX-75-H

PREDICAST #4-1
Disposable Hospital Supplies
C.P. BIRD

(i) Medical hardware - possibly instrumentation - and services - (CRYOGENICS) (Welding Chemicals eg Eutectic UNIBRAZE HOBART

(ii) Distribution, as a service, of industrial goods (possibly involving distributorship of gases and welding products) UNIBRAZE

VACUUMFIELD

(iii) Adhesives or other speciality chemicals

(iv) Food services - with special reference to transport and storage (cross-link to point ii above) and to "convenience" foods

(v) New Business eg Cutler-Federal

This list may call for revision later, with incorporation or substitution of further items from the Group's preferred list of business "themes" for growth - see other current or impending papers.

Meanwhile, there are two specific cases which could be regarded as available for study :-

Harris Calorific : where BOC already has a minority stake, and who handle BOC medical equipment.

Statham Instruments Inc. : a leading manufacturer of transducers (devices for sensing pressures and temperatures) with markets growing now in medical and process-control uses rather than, as formerly, defence and space. BOC has had some recent contact with them.

5 The Group's Strengths

Choice of industrial sectors and decisions on particular venture opportunities must be linked to some analysis of :-

(i) the Group's strengths - the basis for the special contribution that it can offer an American partner;

(ii) the Group's ambitions as an international concern and especially the reasoning that underlies the Group's aim of becoming increasingly international.

These tend to be difficult topics because they are intangible; nevertheless they are important and relevant. Appendix C is an attempt to provide some added light.

6 Practical Steps

Practical steps now proposed are :-

i to conduct a programme of desk research at Hammersmith, using directories, press etc. on specific business opportunities - what kinds of firms exist in selected business areas and size brackets, what are their records of profitability and growth, to what extent and on what terms they have been involved in the merger movement;

ii to talk on an informal and preliminary basis with a very few, possibly only two, American business brokers. These discussions, in conjunction with our own desk study under 'i', should show whether and how far we need to enlist their services. One broker, who claims to have special insights into problems of European firms seeking North American participation, has approached BOC and we may soon have a discussion with him in his Brussels office. Another has been seen in New York by the President of Canox.

Despite the general tone of the present paper, the small possibility remains that an outright acquisition might follow. Finance might be found, as in the well-known recent instances of acquisitions by BP and Plessey, by vendors' readiness to accept a series of instalments from future cash flows of the acquired enterprise. But the more promising avenue would seem to be minority or 50% participation initially.

In any event a formidable volume of work will be involved. One might reasonably predict that the number of propositions to be screened at desk stage over a period of one or two years would run into some hundreds, and that those cases to involve at least some preliminary negotiations would run into some dozens.

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APPENDIX A

KEY STATISTICS 1968

	USA	Canada	UK	EEC	Japan
Population (million)	201	20.8	55.5	185*	101
GNP (US $ billion)	861	60.7	101.8	346*	117.5*
Per Capita GNP (US $)	4,280	2,920	1,830	1,870*	1,170*
Exports (fob) (US $ billion)	34.7	13.1	15.3	64.3	13.0
Imports (cif) (US $ billion)	35.5	12.5	19.0	62.0	13.0
Steel production (mill.ingot tons)	117.0	8.7*	25.9	97.0	65.6
Index of industrial production (1963 = 100)	133	137	117	128	191

* 1967

Sources : IMF, OECD, UN and BSC publications

APPENDIX B

CX-38-L

Selected Points from a Recent Publication

THE INTERNATIONAL CORPORATION

The International Chamber of Commerce, at its 22nd Congress (held a few weeks ago in Istanbul), had as its main subject "The International Corporation". A 200-page "Background Report" was prepared for the meeting; it includes 55 pages of tables and a brief "Epilogue" entitled " On Rights and Responsibilities". We have it in the office together with a 20-page pamphlet prepared after the Congress to provide "definitions and conclusions" on "The Role, Rights and Responsibilities of the International Corporation".

The variety of topics covered can be indicated by listing the chapter headings of the "Background Report" :-

Some Statistics
The International Corporation and the Developing Countries
The Transfer of Technology
Method of Operation of the International Corporation
The Legal Background
The Financial Background
The National Response

To some large extent the author acts both as reporter and critic of earlier published work, - including Reddaway and many other sources.

To select a few from the great number of points covered :-

1 (pp 9-11). The international corporation is neither new nor predominantly American based ("le défi" is international rather than American).

2 (pp 15-16). Author does not share the view that "... the world's economy of the future will be dominated by 300 or 400 super international corporations ---- (and that) --- a global strategy must be adopted to join this... group". He does see the basis for the view: if large corporations succeed in growing at, say, 7% pa but GNP grows only at 3%-4% pa, then share of total held by the large firms must grow. But he observes :-

a In the USA, "... where the integration process has gone on longest ---- relative division of output between small and large companies ---- has not really changed radically since the 1930's"

b A major motive for investing heavily and internationally is that a company has "--- some form of technological advantage"; however, such an advantage cannot last for ever and must be replaced by "--- standardised production, involving numerous competitors---"

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3 (p 17) In the USA, where "--- modern industrial integration has been most complete ----" the growth of big corporations, bringing "--- efficiencies and economic benefits", has not meant the death of the "--- small and local business: which now "--- flourishes --- as supplier, innovator and independent seller of services; indeed, as once new-product technology gives way to standardisation, local business competes successfully in manufacture, as well".

4 (p 18). Within the developed world, where the "--- vast bulk of international corporate activity takes place ---", advanced technological and managerial skills are spread by the international firms and economic integration (EEC, EFTA, LAFTA, "Kennedy Round") aids the process. In the developing countries "--- the international corporation is an important factor in economic development --- it brings technology in the broadest sense --".

5 (p 24) Industrial concentration marked in terms of foreign operations : -

Industries with :-		
Much international investments.	Moderate	Little or None
Chemicals	Food	Steel
Pharmaceuticals	Tobacco	Ship-building
Fibres	Engineering	Aircraft
Oil		
Machinery (incl. vehicles)		
Electrical equipment		

6 (p 27) The "internationalisation" of Swedish industry is very high; between 1960 and 1965 the total amount of investment abroad by Swedish firms nearly doubled.

7 (p 27). The flow of investment abroad by American industry continues to rise, but at a declining rate of increase.

8 (pp. 33-4). Oil industry as a case-history: capital intensive ; fast growing; vertically integrated and international; new entrants in recent years; rate of return 30% in 1955 had fallen below 12% by 1967.

9 (p 38). Developing countries. Their internal market is so small that local manufacturers cannot attain world-competitive cost levels. Motives to establish are usually import-substitution with the "overspill" concept (an exportable margin) to follow. Many instances, but few successes.

10 (p 40). The "specialised production of components among countries, based on their comparative advantages---" is an alternative approach to internationalisation, notably adopted by some tractor, computer and electronic firms.

11 (pp 42-44). Questions of the advantages of local participation in the equity aired -whether at all, or majority, or minority.

Case for 100% ownership where subsidiaries involved in component manufacture, otherwise there can be "intolerable" arguments about transfer prices. "Host nations often exhibit --- inconsistent --- demands on the international corporations" ie if a Government limits the extent of parent company participation it is probably also limiting the incentives for the parent to transfer its supposedly superior technology.

12 (p 48). "The term 'transfer of technology' is an accepted short-hand for a fairly complex procedure --- application of ideas - scientific and others - to the development of marketable products".

Among the subjects touched on in the remaining 100-odd pages are : -

i Nature of technological gaps.

ii Contribution of international firms in developing countries; some special reference to management training and research.

iii Motives that lead firms to invest abroad; references to licensing and cost of capital, tariff barriers.

iv Centralisation versus federation.

v Internationalism can start as a "side-show" yet predominate later. ("--- many more --- European corporations --- may be expected to enter the stream of internationalism--" p. 72).

vi Managerial mobility.

vii Anti-trust laws in USA and EEC.

viii Economic aspects of greater concentration; not all observers accept "conventional wisdom" on "the alleged virtues of size" (pp 94-5).

ix Tax burdens, tax-havens, obstacles to internationalisation of shareholdings. Specific recommendations given on tax changes which would bring about "-- more rational fiscal policies--" (pp 104-5).

x Case for unification of capital markets as and where practicable.

xi Place, as servant to industry, of the "increasingly" international financial institution ("The World Bond League" appears on p.116).

xii The generally uneasy, or at best mixed, response of the nation - state to the international corporation. Economic criteria ("relatively rational" - p.124) tending to get jumbled with the non-economic and irrational.

xiii Some special account of experience in Canada, and in Japan.

HSR/MBW

25 July 1969

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APPENDIX C

20.8.69.

AN INTERNATIONAL STRATEGY FOR THE GROUP - SOME ASPECTS DISCUSSED AFRESH

In the present phase of the Group's planning efforts, work is concentrated mainly on review of the types of business activity that the Group is in and seeks to be in; the aim is closer and well-reasoned identification of businesses. This emphasis on the question of "what" (what business areas) and coupled with it the question "where" does not debar partial re-opening as appropriate of the fundamental question "why" - the Group's philosophy, the basis for successful business strategies.

BOC intends to be an outstandingly successful international industrial organisation; the specific choice of business areas, although vastly important, is as much a matter of means as of ends.

Leaving aside some of its more controversial aspects, the published report summarised in Appendix B suggests that :

a Only a very few and exceptional firms can expect to succeed in doing the very thing that BOC aims to do, ie to grow over a really long term much faster than the typical industrial growth rate as a whole, which itself can differ but little from GNP growth rates (say usually 3% to 5% pa, exceptionally a point or so higher).

b One way of achieving very fast growth could be to have some outstanding technological capability in a particular business and to exploit it internationally. The advanced or outstanding technology of today is likely to become everyone's technology tomorrow, so that sustained success requires a continual refreshing of the technological capability. For a great many firms, however well led, such a strategy would be impossible - it is necessary to be in the right place at the right time, and probably also to have some substantial technological heritage.

c For many firms, therefore, and BCC is probably one of them, the secret of outstanding success must lie somehow elsewhere - in, it might be said, its quality of management and organisation, its attitudes and methods of work. This does not exclude elements of technological capability; indeed some such element is probably an essential.

"Quality of management" can mean many different things; the following list is not exhaustive and there is some overlap within it :-

i An organisation which tries to be a sort of precision machine; tight financial reporting and requirements, yet a definite devolving of some responsibilities from the centre.

Examples General Motors
Some international oil companies
Philips.

ii Outstanding marketing capability applied with fast international transmission of the applied skills; good as innovators; challengers of others in long entrenched positions (sometimes - AP perhaps an example - notably quick decision-making is a component of this strength). Often involves rather uncritical loyalties to the company or its brand names; this can be inimical to constructive problem-solving attitudes.

Examples Procter & Gamble

Air Products

Mars/Petfood

iii Ability to build in some way on a strong technical competence; (ie a fine technical heritage is not enough by itself, high success calls for some element of special style or drive in management or organisation to be added)

Examples Boeing

Hoechst

APV

Rolls Royce

Example of a firm with the potential but not the realisation

Linde AG

iv Highly constructive problem-solving atmosphere within the firm; exceptional capability for business project teams

Examples Du Pont

BOC

v Strength via sheer size with large force of management services at the centre; wide diversity geographically and (though perhaps less so) in product range.

Examples (both questionably successful) Union Carbide

Unilever

vi An organisation with much devolution to fully profit responsible entrepreneurs leading relatively small, flexible units - lean, agressive, often diverse. Nevertheless, bound together by some common link, often the financial strength of the group as a whole.

The "conglomerates", when successful, are examples :-

Slater Walker

I T & T

What practical conclusions does this reasoning have for BOC?

First, since a strictly or predominantly technological capability seems unlikely ever to be BOC's principal source of enduring and above-average attaintment, there is no particular case for a narrow product-range base. The Group's existing fairly wide diversity of products and services, even with some further widening to come, is acceptable.

Second, the major source of Group strength, and the main basis for its increasing internationalism,

should be seen as residing in some aspect of "quality" or "style" in management rather than in some particular capability in engineering, development or marketing. This is arguably to be welcomed, since the applicability of such strengths is more likely to be enduring in time and extendible geographically and industrially than with some primarily technological strength.

Third - and this is as much a suggestion as a conclusion - that the aspect to be selected should be a reinforcement of the existing major strength in the all-round competence of managers and their specialist advisers, and especially the capacity for creative teamwork.

This might mean policies aiming at all-round intensification of the Group's already considerable activities in management recruitment, development and training; and the adding of international dimensions to these activities.

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APPENDIX D

CX-38-4

THE ENGINEERING INDUSTRIES IN NORTH AMERICA - EUROPE - JAPAN, 1966-7

The 300-page report under this title, recently published by the OECD (Paris), contains a mountain of statistics with analysis and comment. It identifies gaps between American and non-American performance, and it gives Britain the unhappy distinction of having the poorest record of any large OECD country.

Key paragraphs on the first issue are :-

"170. Two particularly important facts which stand out from the data discussed above deserve special attention and, if possible, an explanation. Given a comparable level of technical know-how (2) and training in the main producer countries :

- the North American engineering industries' deliveries amount (in value) to about double those of the same industries in the other OECD zones, despite the fact that the latter employ nearly twice as many people, and
- this same North American sector's capital outlay, in terms of turnover, is about half that of the other Member countries together.

171. The apparent contradiction of these two facts excludes any attempt to explain it by the argument that the unit price of labour, which always has been and still is lower outside North America, would justify other countries' preferences for production of a labour-intensive rather than capital-intensive type. It therefore seems that the explanation of the difference between the relative levels of investment and their return (1) should be sought rather within the sector's structure and the demand it meets, and perhaps to a lesser degree (due to these structural differences) in the motives for investment."

"(2) With the possible exception of a few newspaper headline-making industries whose share in production is nevertheless not large.

(1) Which it should be repeated cannot be explained by the play of price disparities (on the contrary) nor by the somewhat arbitrary fixing of official exchange rates."

Report goes on to distinguish the three main motives for capital expenditure :-

i renewal after normal wear-and-tear,

ii to match increased demands,

iii for improvement of the product, and rationalisation;

and to assert, as broadly supportable by the statistics over the years, that :-

---

* Note that this is a document prepared within BOC in February 1968.

- in the USA and Canada "... motive (iii) is never absent and, in fact, is predominant".

- in the UK and (until 1962) Belgium it is mainly motive (i), "... it is difficult to discern much investment of type (iii)".

- in Germany type (ii) has predominated; the rate of production increase has slowed down since 1963 when labour shortages began to be felt.

- in Japan it is (iii) with (ii); "... rapid expansion has been accompanied ... by remarkable rationalisation".

- in Italy and Sweden "... rationalisation predominates but expansion of production is still appreciable".

On causes :-

"175. In view of the fairly similar level of technical know-how and training in the principal producer countries, and the fact that the trend of disparate returns is long-standing, it seems that the explanation of these disparities is to be found less in the attitude of management to capital outlay, or in the economic cycles, than in the basic differences of production structure and demand. In addition to these, but to a lesser degree, account must be taken of certain effects of governmental investment policies."

Hence the report goes on to discuss "Structure of Production" and then "Structure of the Market"

Structure of Production

In Europe, compared with North America: -

- there are in total more people employed;

- there are in total many more establishments;

- the size of establishment, in terms of average number of persons employed, is lower,

- size of establishment, in terms of average sales turnover is much lower (average USA establishment about four times average European establishment)

In Europe, therefore, "... relatively too many firms must invest the same amount of money to modernize their capital stock and to adapt it to market developments. This is doubtless a partial explanation of the fact that in absolute terms the sector invests as much, if not more (1958-1965 inc.) in Europe as in America." Europe suffers from less specialisation, less recourse to sub-contracting and shorter production runs than America;

"178. To sum up, the structure of the sector in Europe entails in all countries a waste of capital invested in most branches; this wastage appears to be greatly reduced in certain cases by the creation of new industries, not only putting to immediate use modern equipment, but also adapting their organisation to benefit from scale economies. There is no doubt that the success in Europe of certain durable consumer goods (refrigerators, cars, etc. in one European country) and also that of some Japanese capital goods (particularly ships) can be largely attributed to far more efficient production methods than

Fuller utilisation of capital, as in America, means faster real depreciation so that "... technical developments can be promptly incorporated ... security against economic obsolescence".

Structure of the Market

European population 50% higher than USA but global purchasing power in USA higher than Europe; "... results not only from greater natural resources, but also and above all from a much more productive economy"

American advantage partly due to uniformity of the market served. European engineering industries export about 33% of their output; compare USA only 7%. And :-

" The heterogeneous export demand which Member countries have to meet, and the technical and administrative obstacles which still hinder trade in Europe, mean that the greater output necessary to meet export demand does not in general make for greater efficiency..."

though it is recognised that these difficulties are less "... for countries which have always had to export to numerous diversified markets abroad."

More on this theme :-

"184. ... in 1961-1963, the European engineering industries spent considerable sums of money in order to instal larger capacity to meet the still high demand and in anticipation of a huge market in the future, and also in order to rationalize their production in face of an increasing labour shortage. But these investments were made in production structures unadapted to a large market - which, moreover, does not exist yet. The slowing down of demand which has occured since has left the European sector with a large surplus production capacity .... Pressure on prices and rising labour costs enhance the effects of insufficient capital returns; it therefore follows that the firms in the sector are short of funds for investment in the installation of more productive equipment".

And "187. ... compared with Europe the Japanese sector has invested in a production structure (with a corresponding market) much better equipped to bring in satisfactory returns on capital. The Japanese engineering industries, sustained by a domestic market that has been expanding strongly for several years, have concentrated their efforts successively on a limited range of products (optical instruments, radios, photographic apparatus, ships, lorries, motorcycles, cars and electrical equipment) and on selected export markets. Their investments, together with efforts to improve firms' organisation, have borne fruit in plenty and have enabled the Japanese sector to outstrip the production (at constant 1958 prices) of Germany in 1964 and of the United Kingdom in 1965 (see Graph 12) with a relatively low rate of new labour recruitment, and without raising prices, achieving an average yearly increase of deliveries per employee of 10 per cent since 1954."

The UK

There are paragraphs dealing in detail with each member-country; those (paras. 219 - 222) on the UK point out that :-

- output (deliveries) per employee, although rising over past years, was in 1966 one of the lowest figures for any OECD country;

- with new investments, likewise, the history is of increase which still leaves it (in relation to number of employees) behind most of the OECD; moreover the new investments themselves seem to have led to no great increase in productivity. "Various factors, such as market and particularly production structure, including trade union structure, hampered a more economic use of the capital invested in the United Kingdom sector."

Scope

There are 21 member countries of the OECD :-

Austria,	Japan,
Belgium,	Luxembourg,
Canada,	The Netherlands,
Denmark,	Norway,
France,	Portugal,
Germany (Federal Republic),	Spain,
Greece,	Sweden,
Iceland,	Switzerland,
Ireland,	Turkey,
Italy,	UK,
	USA.

The report gives some figures for the non-OECD world as well as country-by-country data within OECD.

It is explained that

- " Due to the limited availability of comparable statistics, however, only the following products listed according to the Standard International Trade Classification could be covered in the basic Statistics used for this report".

ie (summary) :-

Machinery and electric machinery
Transport equipment (vehicles of all types, ships, aircraft)
Instruments, watches & clocks (but some exceptions)
Hand tools
Metal household goods (including refrigerators)

Four tables that follow represent a small selection from the great quantity of statistics in the report; they do not incorporate any of the detailed material on individual product groups. The tables are :-

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CX-38-Y

SOME OBSERVATIONS

Table 1
Relative Position of the Engineering Industries, 1965

37% of all UK industrial production is in engineering goods; only Switzerland and Japan show a higher figure.

UK has 9% of OECD total engineering production (compare USA 55%, Germany 10%, Japan 9%)

Table 2
Output (Deliveries) per Employee in the Engineering Industries in Major OECD Countries, 1954 and 1966

Ideally, a "league table" would be in terms of value added ("net output"), but adequate statistics do not exist. Net output is doubtless correlated in some measure with these figures of gross output (= turnover), but the correlation may not be very high.

USA nearly 2½ times its nearest rivel (Japan), 3½ times UK; despite low USA rate of improvement in past years.

If (an extreme, unlikely, assumption; illustration only) rates of increase as shown were to be maintained into the future, then Japan would "overtake" USA in 1980 (in these terms ie output per employee)

The German record and achievement appears in this table (though Table 4 contrasts) no better than the British; scope for rationalisation in Germany?

Table 3
Relative Importance of Imports and Exports in the Engineering Industries (Certain countries only)

UK import ratio not unduly high or rising unduly fast; suggests that UK emphasis needs to be on export promotion rather than import substitution.

Table 4
Salient Statistics of World Trade in Engineering Products

UK still a much bigger engineering exporter than Japan, but soon to be overtaken if recent trends continue.

EEC countries' imports from outside EEC, especially from USA, large and rising, despite the tariff barrier.

A 3995

APPENDIX D
Table 1

CX-38-2

RELATIVE POSITION OF THE ENGINEERING INDUSTRIES, 1965

	Contribution of engineering industries to the total:-		Each country's contribution to OECD Grand Total of engineering production
	National income (GDP)	Industrial production	
	% of GDP	% of all industrial production	%
Germany	16	32	10
France	13	32	6
Italy	7	19	2
Benelux	10	25	2
sub-total EEC	13	31	20
UK	16	37	9
Sweden	13	34	1.5
Switzerland	17	44	1.3
6 smaller European countries*	3 to 10	12 to 15	2
Sub-total Europe OECD (including EEC)	13	31	34
Canada	7	18	2
USA	13	36	55
Japan	14	38	9
OECD	13	33	100

* Austria, Norway, Portugal, Greece, Ireland, Spain.

Source: Table 2 of OECD Report

(19.2.68)

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APPENDIX D
Table 2

CX-38-Z-1

OUTPUT (DELIVERIES) PER EMPLOYEE IN THE ENGINEERING INDUSTRIES IN MAJOR OECD COUNTRIES 1954* and 1966*

	$ USA000, 1958 price level		Average rate of increase % pa, over 12 years
	1954	1966	
USA	20.3	24.9	1¼%
Japan	3.1	10.5	10%
Sweden	6.8	9.6	3%
EEC	5.3	8.0	3½%
UK	5.0	6.9	2¾%
Within the EEC			
Germany	5.1	6.9	2⅓%
Italy	4.7	7.3	4⅓%

* 3 year moving-averages, 1966 estimated

For source see Graphs 10 and 11 of OECD Report

(19.2.68)

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APPENDIX D
Table 3

CX-38-Z-2

RELATIVE IMPORTANCE OF IMPORTS AND EXPORTS IN THE ENGINEERING INDUSTRIES
(Certain countries only)

	Share of imports in total domestic demand for engineering products		Share of exports in total production	
	1962 %	1966 %	1962 %	1966 %
UK	10.5	13.1	31.7	31.3
Germany	14.0	18.4	40.0	45.0
France	16.4	20.5	21.2	23.5
Italy	28.9	33.9	31.7	49.7

Source: Tables 11.3 and 11.4 of OECD Report

(19.2.69)

A 3998

APPENDIX 2
Table 4

CX-38-2-3

SALIENT STATISTICS OF WORLD TRADE IN ENGINEERING PRODUCTS

$ US million

		Exports	Imports -	- including imports from -			
				USA	Germany	Japan	UK
USA	1965	11,100	4,000	-	920	790	510
	1966	12,350	5,800	-	1,170	1,080	740
Germany	1965	9,400	2,980	520	-	80	260
	1966	10,600	3,040	530	-	80	280
France	1965	3,000	2,400	450	880	10	250
	1966	3,400	2,850	480	1,080	25	290
Italy	1965	2,500	1,300	200	490	10	130
	1966	2,900	1,510	230	600	10	150
Japan	1965	3,200	750	450	100	-	60
	1966	4,000	810	490	100	-	70
UK	1965	6,200	1,800	550	370	50	-
	1966	6,800	2,020	580	420	85	-
WORLD	1965	52,000					
	1966	59,000					

Source: Tables 111.17 and 111.18 of the OECD Report

19.2.68.

A 3999

CX-38-2-4

A NOTE ON STATHAM
(STATHAM INSTRUMENTS INC.)

Introduction

The company is engaged in the design, development, manufacture and sale of instruments for use in making precise measurements, most of which employ the use of a transducer which is the subject of many of the company's patents.

The company has 950 employees and premises in Los Angeles, Oxnard, California and Puerto Rico. It also owns a 24 acre site in Malibu, California.

Sales and Profits

Sales (US $ millions)

Year to 31 May	1964	1965	1966	1967	1968	9 months to 28.2.1969
Aerospace	8.0	8.8	10.2	10.0	5.9	(not available)
Medical & Indus:	1.4	2.4	4.5	5.7	6.1	
Total Sales	9.4	11.2	14.7	15.7	12.0	10.4

The above figures show the declining importance of Aerospace sales in the company's product mix and the substantial sales growth achieved in medical and industrial products. However, growth in the latter field appears to have largely been achieved by the following cash acquisitions.

1964 - acquired Medicon Division of Quality Precision Products Inc., Los Angeles and Mediquipment Co., Santa Fe Spring, California.

1965 - April. Acquired Electro-Medical Engineering Co. (now Statham Medical Instruments Division).

1968 - January. Acquired Exactel Instrument Co., Mountain View, California.

- May. Acquired assets of National Electric Instruments Co., Elmshurst, New York.

Details of the purchase price or sales of the above acquisitions are not available at this time.

Pre-tax, Pre-interest Profits

Year to 31 May	1964	1965	1966	1967	1968
Profits (US $ million)	1.1	1.4	1.8	2.2	.2
" % of sales	11.6	12.9	12.I	14.1	1.9

CX-18-Z-5

The following table compares costs and profits for 1967 and 1968.

(US $ Millions)

	1967		1968	
		% Sales		% Sales
Sales	15.7	100.0	12.0	100.0
Cost of Sales	10.5	67.1	9.2	76.4
Selling Expense etc.	3.0	18.8	3.0	25.5
Pre-tax & interest profit	2.2	14.1	.2	1.9

The 1968 annual report gives no reasons for the profit decline, which has continued in the 9 months to 28 February 1969 (pre-tax figures are not available but net income after tax credits was $340,260 against $424,440 for the same period of 1967/8.) As the company does not provide a breakdown of profits between its aerospace and medical/industrial businesses, it is not possible to deduce whether the profit decline is due to losses on aerospace or whether aerospace has been the only profit contributor in the past so that the sharp decline in this activity has revealed losses experienced on the medical/industrial side. The acquisition of Exactel Instrument Co. is unlikely to have had much effect as it was only acquired in January 1968.

Capital Employed

From 1964 to 1968 the company's Working Capital increased from $3.2 million to $6.7 million while borrowings of $550,000 have been repaid. Stocks increased by $1.1 million or 30% during the year ended 31st May 1968 although sales during the same period declined by 23%. This increase in stocks may have been partly due to the acquisition of National Electric Instrument Company at the end of May. Current liabilities at that date included $800,000 representing the balance of the purchase price for the assets of that company.

Earnings & Share Price

	1964	1965	1966	1967	1968
Earnings (US $ million)	0.9	1.1	1.3	1.6	.2
Earnings per share*	$.69	$.84	$1.04	$1.24	$.15
Average share price*	$10.5	$15.5	$14.2	$22.3	-
P/E Ratio	15.3	18.4	13.7	18.0	-

* adjusted for 50% Stock dividend on 14th October 1966.

The company's shares are 42% owned by L.D. Statham (President) and his family. The shares are quoted on the American and Pacific Coast Stock Exchanges. No cash dividends have been paid by the Company.

Currently the share price is trading at a 1969 'low' of $25, down from a 'high' for the year of $39½. At $25 per share the company's market capitalisation is $32 million against stockholders equity (book value) of $10 million.

Cx-38-2-6

Observations

There have been some discussions on the possibility of BOC distributing Statham's products outside the US and Statham distributing BOC's medical equipment within the US. The continued independence of Statham will depend on its ability to make profits on medical and industrial sales. The continuation of losses for the nine months to February 28th 1969 raises considerable doubt over the future of the company which may be somewhat clarified when the 1969 annual report is available.

BOC GROUP ACTIVITIES

IN

NORTH AMERICA

Already agreed are some guide lines for the search for business opportunities in North America. The communications to support this activity have been set out in L. E. Smith's letter of August 18, 1969.

Much effort in the BOC group has been on Long Range Planning. This has focused attention on the GAP and, as a result, a decision has been made to enter the USA market. While opportunity may well arise unexpectedly, it is more apt to occur as the result of a predetermined STRATEGY. Basic to any successful strategy has to be MANAGEMENT INTEREST as set out in the guidelines.

To date several opportunities have arisen. A few have been pursued and discarded. The variety of those remaining raises some pretty basic questions. Following is a list of those companies where some opportunities are likely. Some discussion has been had except where marked with an asterisk. Sales in million US dollars is given where known as an indication of size.

Type of Business	Company	Sales Million Dollars
Medical	American Sterilizer	55
	Statham Instruments	14
	*Fraser Sweatman	
	Capital Surgical	3.5
Industrial Gases	Northern Natural Gas	406
	*AIRCO Gases Division	116
	*Puritan-Bennett	18
	Burdett of Cleveland	16
Cryoproducts	Cryenco	1.2
	*AIRCO Cryogenics	4
	Minnesota Valley	
	Cosmodyne	

BOC GROUP ACTIVITIES

IN

NORTH AMERICA

Type of Business	Company	Sales Million Dollars
Vacuum	NRC (Norton)	15
	MRC	2
Welding Products	Unibraze	8
	*Hobart	200
	*Thermal Dynamics	
	Uniweld Alloys (Canada)	0.5
	*Miller Electric	20
Metals	Deloro	10
	*Fansteel	
	Hart Metals	6
Consumer Products	National Tape	
	Cutler-Federal	6
	Aro-Firewell	
Chemicals	Oakite	27
	Virginia Chemicals	28
	Solar Aircraft	
	Synvar-Southern	
Other	*Luzerne Rubber	
	*Minor Rubber	
	**J.A. Tumbler Laboratories (Canada)	1.5
Advanced Products	Waste Water Treatment Corp.	
	Cryomagnetics Inc.	
	Microperv Inc.	
	Malaker Corp.	
	Amicon Corp.	
	Aeroprojects Inc.	

* - no contact made

** - purchase agreement signed

CX-40-C

BOC GROUP ACTIVITIES

IN

NORTH AMERICA

The following questions need answering in today's environment. The answers should be firm until some action results or until after some months reappraisal is indicated.

1. Is our basic objective to be in business in the USA, or is it to sell our products into the USA?

2. What is the most important business sector BOC wishes to pursue? If more than one, can these be listed by priority? e.g. medical, industrial gases, vacuum, etc. Can any be excluded?

3. Is our financial limitation still $25-million? What return is expected and what is it based on?

4. If controlling interest is not practical, what size of minority interest is acceptable? If a minority position, what side advantages are desired?

5. What consideration should be given to advanced technologies? Should we follow Union Carbide's example and establish an Advanced Products Group with funds available for minority equity investment?

These questions will no doubt raise others. While a general discussion has some advantages, the purpose is to obtain top management agreement and commitment on some specific actions.

September 4, 1969
J. A. Perham

CX-41

The British Oxygen Company Limited

Hammersmith House,
London W6
Telephone 01-748 2020
Telex 22833
Telegrams Britoxygen London W6

A 4005

Our ref: IG/MEW

Dr. A. Muller
Still Hollow Road
RD 2
LEBANON
New Jersey 08833
USA

23 September, 1969

Dear Al,

Many thanks for your letter dated 18 September enclosing the interesting information on the US merchant hydrogen market which I have passed to Bill Chater, who of course you know well. I have asked him to come back with any discussion points prior to your visit, in case there are any matters he wishes to raise.

Also many thanks for the US Department of Commerce publications. This service from you is particularly useful now that this service is no longer available, other than to US citizens.

With very best wishes and looking forward to seeing you.

Yours sincerely,

I. Greenfield.

c.c. Mr. J.M. Williams
Mr. R.C. Hesketh-Jones
Mr. J.A. Perham

4006 Still Hollow Road
Lebanon, New Jersey 08333 USA

October 21, 1969

Mr. L. E. Smith
The British Oxygen Co., Ltd.
Hammersmith House
London, W6, England

Dear Leslie:

I regret that your busy schedule during my recent trip to London made it impossible for me to meet with you privately, since I had hoped to discuss several matters with you that are difficult to cover in regular correspondence. I hope that an opportunity for such discussions will occur in the not too distant future.

During the period just prior to my trip I spent considerable time summarizing all of the active propositions that have been developed in the acquisition/joint venture area and came to London prepared to discuss these situations in depth with your staff. Upon arrival I was informed that a decision had been reached to explore the opportunities that exist in the U.S. in the industrial gas field, and that no discussion of alternatives was needed. Naturally, it is presumptuous of me to question this decision, but lacking a clear explanation for what appears to be a major change in policy and strategy, I am obviously quite curious as to the reason for this change. Anything you can do to "clear the air" in this connection will be greatly appreciated.

In view of the above, I am taking the liberty of setting forth below the requests for assistance I have in hand which constitute my current assignments in the U.S.; together with the principal BOC contact for each job.

1. Acquisition/Joint Venture Area
(Key BOC contacts — J. A. Perham/C. Hesketh-Jones)

   (a) Terminate all active propositions, except those relating to the industrial gas business.

   (b) Assist in the analysis and evaluation of opportunities for BOC in the industrial gas area.

2. Technology (Key BOC contacts - J. M. Williams/J. D. Gardner)

   (a) Investigate new low temperature refrigeration concepts: FOA - energy separation; Malaker Stirling cycle engine

   (b) Investigate ion implantation techniques and equipment

   (c) Monitor use of oxygen and ozone in waste treatment

   (d) Monitor U.S. superconductivity developments

   (e) Investigate new methods of welding and joining

Mr. L. E. Smith
The British Oxygen Co., Ltd.

October 21, 1969
page 2

3. Commercial Activity (Key BOC contact - C.E. of appropriate division)

(a) Locate a manufacturer interested in producing Root's type vacuum and positive pressure blowers under agreement withEdwards (W. Smith)

(b) Locate outlets for the sale of industrial gas equipment in the U.S. (N. Rickett)

4. Miscellaneous

(a) Obtain information on Air Products "Apache" gas (H. Rich)

(b) Interpret U.S. gases statistics for Central Planning (H. Rich)

(c) Obtain U.S. Department of Commerce reports for Central Planning (H. Rich)

My present understanding regarding priority of interest is that work related to item 1 should be given preference over the other areas, but I am certain that those in BOC concerned with the other subjects are unaware of this priority. It would be helpful, therefore, if those concerned are properly notified in this regard.

Invoices for my expenses for the period September 16 - October 15 inclusive, and my consulting fee for the month of October are attached.

With kind regards,

Very sincerely yours,

Albert Muller

AM-cs
cc-Mr. J. A. Perham
Canadian Oxygen Limited
355 Horner Avenue
Toronto 14, Ontario, Canada
cc-Mr. Hesketh Jones
British Oxygen Co., Ltd.
London, England

A 4008

BOC MANAGEMENT BULLETIN

CX-43-A

No.59

21 October 1969

NOT FOR YOUR EYES ONLY!

This bulletin is issued on the authority of the Group Managing Director and Managing Directors for the general information of management and staff. Please give it appropriate wide circulation.

1. CHEMICALS & METALLURGICAL DIVISION

Appointment of Chief Executive

Dr R.B. Sims, aged 49, previously Managing Director of Nuclear Design & Construction Ltd, has been appointed to fill the vacancy created when Mr J.M. Williams became Managing Director earlier this year.

Dr Sims becomes a member of BOC's Management Advisory Board and takes over responsibility for all the Group's chemical and metallurgical activities, including the chemical producing plants at Chester-le-Street (Co.Durham), Maydown (N.Ireland) and Odda (Norway), also metallurgical factories at Rainham (Murex Ltd) and Widnes (High Speed Steel Alloys), as from 1 November 1969.

Dr Sims' previous appointments include that of Director of Engineering, Davy United Engineering Co, and Director General, Research & Development, National Coal Board.

2. ADVANCED ENGINEERING DIVISION

Appointment of Chief Executive

As from 1 November 1969 Mr A.I.A. Ray, aged 42, currently Managing Director of Elliott Process Instruments Ltd (part of the English Electric/GEC Group) becomes the first Chief Executive of this recently formed division and takes over responsibility for Edwards High Vacuum International, Cryoproducts and medical and aviation equipment.

Mr Ray has wide experience of management in sophisticated fields of engineering, including process instrumentation and the manufacture of nuclear instruments for the medical market. Previous appointments include those of Chief Engineer of Elliott Electronic Tubes, General Manager of Elliott Bros (London) and Joint Managing Director of Elliott Process Automation.

Mr Ray, who becomes a member of BOC's Management Advisory Board will, for the time being, be based on Hammersmith House and will be joined by Mr C.W.G. Baird from Gases division, who has been appointed Divisional Accountant.

3. WELDING PRODUCTS DIVISION

General Manager, BOC Deutschland

Mr Heinz Küllmar, previously General Manager BOC Deutschland GmbH, has resigned from BOC. He was succeeded on 1 October by Mr D.A.D. Morgan, formerly Divisional Planning Manager, Food Services Division, now resident in Solingen Germany, who responds to Mr J.F. Wilson, Divisional Planning Manager.

4. GASES DIVISION

Fuel Gas Services

Mr R.J.G. Archer, at present Operations Manager, Food Processes, has been appointed Manager, Fuel Gas Services, with effect from 1 November 1969.

Mr Archer, who will respond to Mr R.L. Tickell, Distribution Manager, will have as his prime concern the promotion and development of BOC's fuel gas services to industry. He will be responsible for ensuring that the existing services are integrated and profitable. These consist of the Fuel Gases Engineering Department at Chester-le-Street and the transportation of liquid natural gas (LNG) and liquid petroleum gas (LPG) on behalf of Gas Boards and the oil companies.

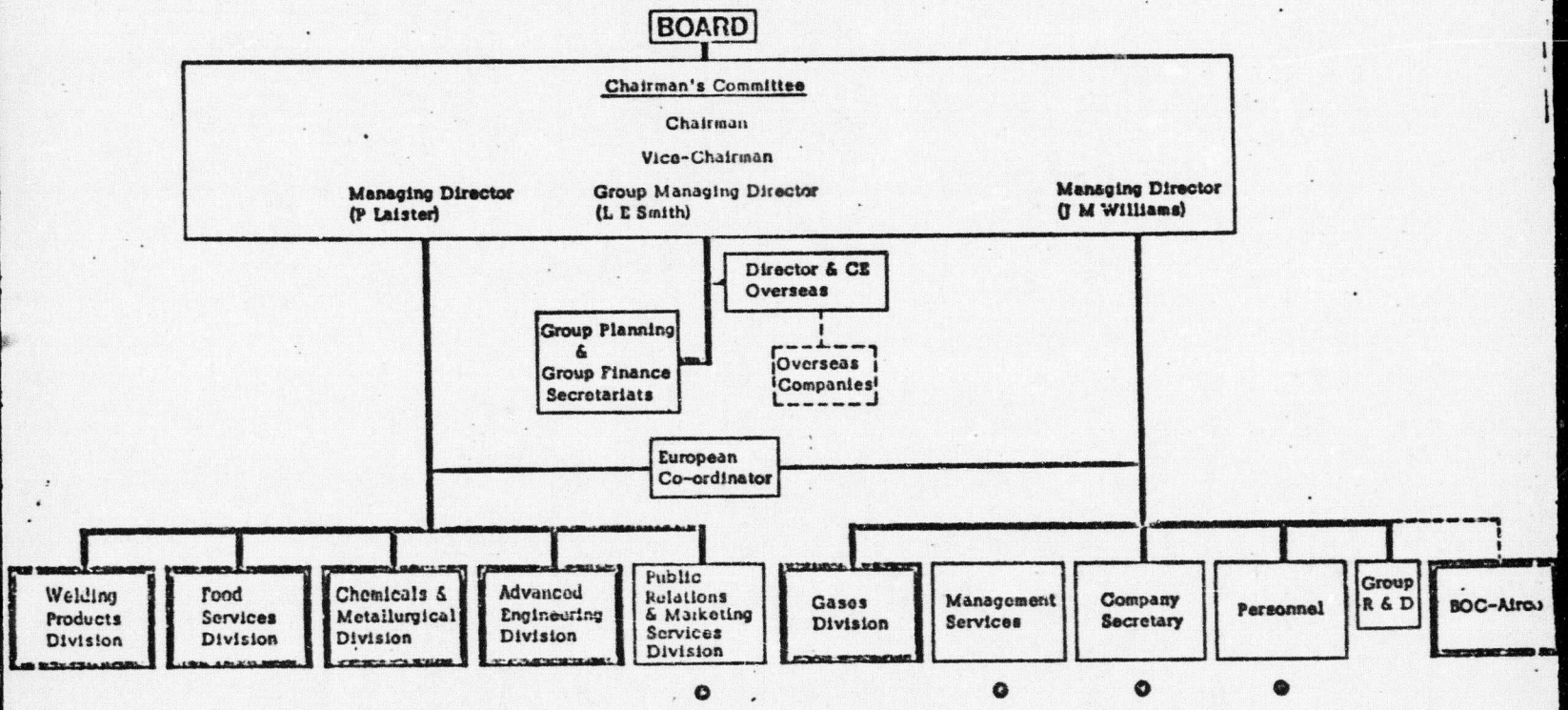
5. GROUP PLANNING SECRETARIAT

Mr J.B. (Bruce) Sutherland who is at present with Productivity Services in Gases division, joins the planning team under Mr H.S. Rich on 1 November. Mr Sutherland (who is no relation to Mr J.B. Sutherland, the MD of Afrox) joined BOC in 1967, is a chemical engineer and was previously with the Shell Chemical Company Limited.

6. COMPANY ORGANISATION

A chart showing the organisation of the Group in the UK as set out in MB No.52 of 18 July is attached. The main products and services of the Trading Divisions is given in the insert in 'Air to a Fortune' which was issued to all recipients of MB No.55.

BOC ORGANISATION
(in the UK)



● Services provided to all BOC divisions and also on a limited scale to Overseas Associated Companies

▭ Trading divisions

▭ Corporate services

Compiled by PR & MS Division HH September 1969

A-4010

CX-44-A

A 4011

CONFIDENTIAL

INDUSTRIAL & MEDICAL GASES IN THE USA
STATISTICS AND OTHER INFORMATION

Hammersmith House.
6 November 1969.

CX-44-B

A 4012

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SECTION 1

INDUSTRIAL & MEDICAL GASES IN THE USA
STATISTICS AND OTHER INFORMATION

These papers have been prepared at Hammersmith House under the guidance of Group Planning Secretariat, drawing on a variety of published and private sources.

The aim has been to produce a concise, general survey of the available facts. There has been some element of interpretation where it has been necessary to reconstruct information; but comment and conclusions for BOC Group policies are reserved for separate documents.

In the interests of speed in preparation and digestibility of the finished product, some of the more detailed material has been omitted - although remaining on file in Hammersmith House in the form of source material or working papers. Nevertheless, all available material of wide significance has been summarised, or its existence and nature otherwise indicated, in the papers presented here.

6 November, 1959

A 4017

SECTION 2

SCOPE AND DEFINITIONS

CX-44-H

A 4018

SECTION 2

SCOPE AND DEFINITIONS

These papers cover the following gases :-

(a) ASU Gases

i Oxygen (industrial - see separate "medical" heading below).

Tonnage - captive plants and supply schemes, plus general pipeline distribution from a central facility.

Liquid

Compressed

ii Nitrogen

Tonnage - captive plants and supply schemes, plus general pipeline distribution from a central facility, but excluding fertiliser plants.

Liquid

Compressed

iii Argon

Liquid

Compressed

(b) Fuel Gases

i Acetylene

Dissolved Acetylene

On-site acetylene generation but excluding tonnage acetylene for use as a chemical feed stock.

ii LPG

Bulk)
Cylinders) where used for industrial (eg Oxy-fuel gas) processes.

iii Natural gas (where used as an alternative to acetylene or LPG in BOC's traditional - eg flame cutting processes).

iv "Special" fuel gases

MAPP)
Acetogen) Bulk)
Apachi etc.) Cylinders) used for BOC's traditional oxy-fuel gas processes.

(c) Carbon dioxide (merchant only)

i Solid

ii Liquid - in bulk tanks and in cylinders

(d) Hydrogen

i Pipeline (supply schemes)

ii Liquid

iii Cylinders, including large fixed cylinders on trailers or other vehicles.

but excluding captive plants for petroleum refining and chemicals.

(e) Carbon Monoxide

i Pipeline (supply schemes)

ii Liquid

iii Cylinders

but excluding captive plants for chemicals etc.

(f) Helium

i Liquid

ii Compressed

(g) Medical Gases

i Oxygen - liquid and compressed

ii Nitrous oxide (including, but separated out, non-medical users)

SECTION 3

COMPARATIVE GENERAL ECONOMIC DATA : USA AND OTHER INDUSTRIAL COUNTRIES

CX-44-K

SECTION 3 (a)

Table 1

USA - KEY ECONOMIC STATISTICS 1967/68

	USA	Canada	UK	EEC	Japan
Population (million)	201	20.8	55.5	185	101
GNP (US $ thousand million)	861	60.7	101.8	346	117.5
Per Capita GNP (US $)	4,280	2,920	1,830	1,870	1,170
Exports (fob) (US $ thousand million)	34.7	13.1	15.3	64.3	13.0
Imports (cif) (US $ thousand million)	35.5	12.5	19.0	62.0	13.0
Steel production (mill. ingot tons)	117.0	8.7	25.9	97.0	65.6
Index of industrial production (1963 = 100)	133	137	117	128	191
Turnover of Chemical industry (US $ thousand million) (1967)	42.4	2.1	6.9	23.9	8.1
Deliveries of engineering products (US $ thousand million) (1966)	165	na	20.9	47.7	25.7
Turnover in industrial and medical gases (2) (US $ million)	710 (1)	65	111	350	75
Turnover in welding products (3) (US $ million)	444	45	62	202	50

(1) For the US, there is also a more narrowly interpreted figure quoted which probably includes government owned helium production and miscellaneous receipt and rentals etc, giving a turnover of $538 million. Both figures relate to 1967.

(2) Industrial gases is interpreted to include acetylene, Ar, CO_2, He, H_2, N_2, O_2, and N_2O. The coverage of both acetylene and hydrogen is wider than is indicated in the Scope and Definition of Items report.

(3) Welding products includes gas and arc welding equipment accessories and consumables.

Sources: IMF, OECD, UN and BSC publications
US Department of Commerce and estimates made within BOC

CX-44-L

USA INDEX NUMBERS OF INDUSTRIAL PRODUCTION AND OTHER INDICATORS OF ECONOMIC GROWTH

SECTION 1 (b)
Table 2

1961 = 100

	1967	Average growth rate 1961-67 % p.a.
Turnover in industrial gases (4)	163	8.5
Total industrial production (1)	143	6.1
Total manufacturing industries	144	6.3
of which food, beverages and tobacco	120	3.1
Chemicals, coal and petroleum products	156	7.7
Metal manufacture (2)	134	5.0
of which steel production	129	4.3
Metal products (engineering)	144	6.3
Total national product (3)	136	5.3
Total per capita national product	125	3.8

(1) including mining, manufacturing and utilities

(2) including steel and non-ferrous metals

(3) at constant factor cost

(4) based on Current Industrial Report series M28A, US Department of Commerce, Bureau of Census.

Source: US Department of Commerce, Bureau of Census.

COMMENT

This table shows the growth of the US economy and the growth of the value of shipments respectively for the period 1961-67, historically an above average period of expansion for the country.

It is clear, however, that we cannot expect an equally fast growth of demand in the US during the next 5 or 6 years due to the combination of many internal and external economic factors.

Other estimates published by the US Department of Commerce put both the growth rate and output of the industry higher but the precise reason for the rather wide difference between the two sets of figures is not fully understood.

A 4023

CX-44-M

SECTION 3 (c)

Table 3

HEALTH EXPENDITURE IN £ STERLING AND AS A PERCENTAGE OF GNP

Country	Year	Health Expenditure £ million	As % of GNP	Rate of Growth* of Health Expenditure % pa
UK	1967	1,594	5.1	7.77
Sweden	1965	456	4.9	13.9
Holland	1967	372	4.9	11.4
Germany	1967	1,825	2.3	9.4
Italy	1967	1,336	4.7	12.9
Belgium	1967	389	4.8	9.8
Luxembourg	1965	9	3.4	7.3
USA	1968	22,310	6.5	9.9
Canada	1964	860	4.7	10.8
New Zealand	1967	77	2.4	7.1
India	1968	42	-	15.3
Australia	1967	144	4.9	6.2
Japan	1967	892	1.9	14.9

*Rates of growth are from 1958 - 1967

Main Sources: UK Annual Report of Minister of Health, WHO Statistical Yearbook, 1968, An International Study of Health Expenditure, B. Abel-Smith, 1967.

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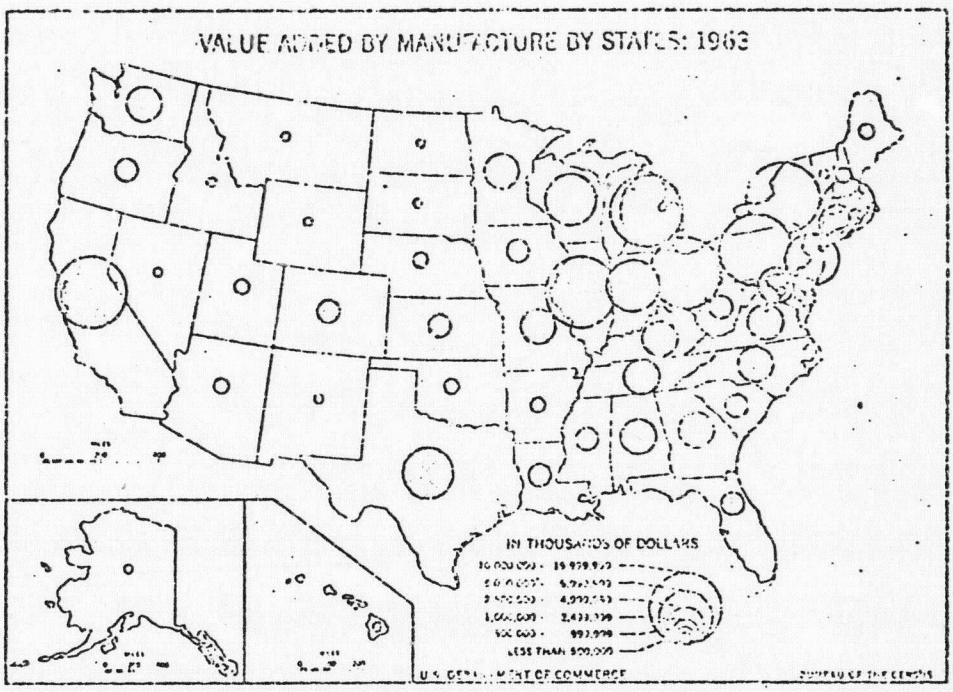
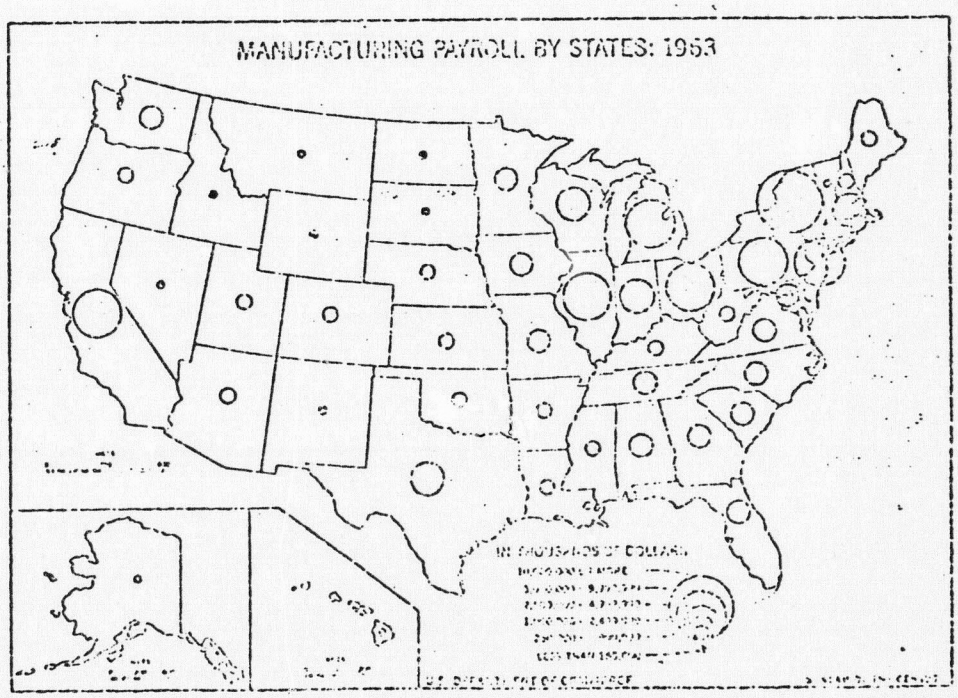
INDUSTRIAL AMERICA

SECTION 3 (d)

Table 4





SECTION 4

INDUSTRIAL GASES

a General Review

	1961 £ million	1967 £ million	Average growth of value of shipments % p.a.
Acetylene	94.4	87.2	- 1.1
Carbon Dioxide (total)	48.5	47.4	- 0.5
of which Liquid and gas	23.8	29.4	3.5
Solid	24.7	18.0	- 5.4
Argon (high purity total)*	15.2	25.3	8.8
of which gas	8.6	9.3	1.3
liquid	6.6	16.0	15.9
Hydrogen (total)	11.4	37.1	21.8
of which high purity*	10.1	36.3	23.8
lower purity	1.2	0.7	- 9.4
Nitrogen (high purity total)*	35.4	93.3	17.6
of which gas	14.8	25.2	9.5
liquid	20.6	68.1	22.0
Oxygen (high purity total)*	113.6	188.9	8.8
of which shipped as gas	73.6	108.3	6.6
shipped as liquid	40.0	80.6	12.3
Nitrous oxide	5.7	4.4	- 2.4
Other Industrial Gases	7.5	54.7	37.0
Industrial and Medical Gases Total	331.7	538.3	8.5

Not within the definition given in Section 2 (scope and definitions). It includes total shipments, including interplant transfers. It excludes information from railroad shops, shipyards, welding shops and small establishments using portable generators.

Not within the definition of Section 2. It excludes amounts vented, used as fuel, etc., and amounts produced and consumed in the manufacture of synthetic ammonia and methanol, but includes an unspecified amount produced for sale or interplant transfer to plants consuming this gas in the production of ammonia. Also excludes amounts produced by the ammonia dissociation process (cracking of ammonia). Includes amounts of hydrogen produced by some, but not all, petroleum refineries producing hydrogen from catalytic reforming operations.

It excludes hydrocarbons such as LPG etc. or halogenated hydrocarbons, as well as high purity helium produced by government owned plants. Distributors of industrial gases and establishments primarily engaged in shipping liquid oxygen are also classified outside this industry. It also excludes manufacturing of fluoride, ammonia, sulphur dioxide as well as liquefied natural gas.

* High purity is defined as follows :

Argon	99.97 - 100%
Hydrogen	99.5 - 100%
Nitrogen	99.5 - 100%
Oxygen	99.5 - 100%

Source: Current industrial report, US Department of Commerce Bureau of Census. Series M.28.A, several issues

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CX-44-P

PRODUCTION TRENDS AND VOLUME GROWTH RATES OF INDUSTRIAL GASES - USA

	Production					% Average annual growth rates of production volume			
	1954	1958	1963	1966	1968	1954-68	1958-63	1963-66	1966-68
[illegible]	6,390	10,256	14,730	16,500	14,900	6.1	7.5	4.0	-5.4
[illegible]	202	377	970	1,700	2,215	18.7	21.0	20.2	14.5
[illegible]									
[illegible] And Gas (short tons)	190,305	338,361	648,725	703,000	715,000	10.0	13.9	2.9	0.9
[illegible]ky ice) (short tons)	559,220	467,351	434,184	380,000	363,000	-3.2	-1.4	-4.5	-2.5
[illegible]	191	334	2,232	4,500	5,000(3)	26.0	46.5	26.3	5.4
[illegible] (b)	27,759	42,415	95,608	148,000	203,000	16.0	17.7	15.8	17.1
[illegible] purity	2,373	6,549	49,674	90,000	116,000	32.0	50.0	22.0	13.6
[illegible] purity	22,108	36,485	128,544	213,000	248,300	18.7	28.6	18.4	7.9
[illegible] purity	na	1,211,887	1,756,517	2,097,000	1,790	na	7.7	6.0	-8.2
[illegible] (mill.)	na	453,000	729,000	932,000	1,020,000(3)	na	10.5	8.6	7.0(3)

[illegible] definition than given in Section 2. Covers [illegible] for all purposes.

[illegible] definition than given in Section 2. Covers [illegible] all chemical uses.

[illegible] within DOC

[illegible] of Commerce [illegible]

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ployment (number):						
Total (1)	10,363	10,265	9,809	11,000	9,090	7,900
Production workers	6,315	5,943	5,250	5,850	4,250	4,080
Percent in production	0.609	0.539	0.532	0.532	0.468	0.517
yroll :						
Total (£ million)	44	60	67	83	23.4	22.8
Production worker wages (£ million)	25	32	33	40	11.9	12.2
Average hourly production worker wages	1.92	2.78	3.02	3.39	1.27	1.43
st of materials (£ million)	78.6	140.0	164.4	266.0	21.9	27.2
e added by manufacture						
Total (£ million)	121.8	221.8	260.2	444.0	40.6	52.0
Per production worker (£ 000)	19.3	37.3	49.6	75.9	11.5	12.7
Per employee (£ 000)	11.8	21.6	26.5	40.3	5.4	6.6
ue of shipments (£ million)	200.8	362.2	425.4	710.0	70.5	81.0
st of materials in relation to value of shipments	0.392	0.386	0.386	0.380	0.310	0.343
Capital expenditure (£ million) (3)	20	49	55	85	30	27.4

(1) Thought to exclude distributors in figures, but included in the UK case

(2) Estimated by US Department of Commerce

(3) Includes expenditure for plants under construction, but not in operation.

Note: Sterling has been converted at £2.80 and £2.40 for 1963 and 19 respectively, thus distorting internal consistency of comparison.

Source: BOC Gases Division returns t UK Census of Production

Source: Bureau of the Census, US Department of Commerce
Business and Defense Services Administration Estimates

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COMMENT

This table should be used with special care, both because the basis of compilation may be different and cost structures are also different, cost of power, wages rates, etc.)

Another major difference stems from the fact that the US data is thought to exclude distributors and merchants of gases, while the BOC figures reflect a fully integrated production and distribution structure.

The relatively high rate of investment by BOC is a further point of interest.

Notable in this table are the extremely high figure for value added by the US industry, which is well above the chemical industry average, while the UK figure is below that for chemicals.

	Value added per head US / 1967	
	USA	UK
Chemical industry	23,810 (1)	7,700
Industrial gases	40,000	6,600 (2)

(1) 1966

CX-44-8

SECTION 4 (b)

INDUSTRIAL GASES

b ASU Gases

i Oxygen

ii Nitrogen

iii Argon

USA - PAST TRENDS AND FORECAST OF TOTAL OXYGEN CONSUMPTION BY TYPE OF DELIVERY - 1957-1975

SECTION 4 (h(i))

Table 8

Short tons per day

Type of Delivery	1957	1963	1967	1970	1972	1975
Merchant						
Liquid	2,080	3,340	4,600	8,500	11,250	16,000
Bulk gas	360	250	195	150	150	150
Cylinders	330	310	230	200	200	200
Total merchant	2,770	3,900	5,023	8,850	11,600	16,350
Tonnage						
Pipeline						
High Purity	800	9,780	19,300	30,150	37,920	51,300
Low Purity	920	1,725	2,185	2,000	1,500	800
Captive						
High Purity	920	1,835	1,615	920	900	900
Low Purity	2,270	3,680	3,220	2,400	1,900	1,400
Total tonnage	4,910	17,020	26,820	35,470	42,220	54,400
Total all	7,680	20,920	31,845	44,320	53,820	70,750
Total in thousand million cu ft	66	180	274	382	462	608

Source: Unpublished Report

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Production (1)	Shipments, including Interplant Transfers								
	Total			Shipped as Gas (2)			Shipped as Liquid		
Thousand Million cu.ft.	Quantity thousand mill.cu.ft.	Value $ million	Average Value ($/ 000 cu.ft)	Quantity thousand mill.cu.ft.	Value $ million	Average Value ($/ 000 cu.ft.)	Quantity thousand mill.cu.ft.	Value $ million	Average Value ($/ 000 cu.ft
78.6	73.4	113.6	0.809	48.5	73.6	1.51	24.9	40.1	1.61
129.6	119.0	136.4	0.858	90.0	89.2	0.99	29.0	47.3	1.62
182.1	172.4	172.5	1.00	132.2	97.5	0.74	40.1	75.0	1.86
212.8	202.4	173.4	1.14	159.4	106.9	0.67	43.0	67.0	1.55
212.8	202.4	173.8	1.14	159.4	106.9	0.67	43.0	67.0	1.55
273.4	233.6	189.0	1.54	189.6	108.3	0.57	44.0	80.6	1.85
Average growth rate 1961-67 %	21.4	9.0	-	25.1	6.6	-	10.0	12.3	-

(1) 99.8% of this is produced by ASU's, the rest by electrolytic means

(2) Thought to include supply schemes.

Source: US Dept. of Commerce

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CX-44-V

SECTION 4 (5

Table 10

COMPARISON OF OXYGEN MARKETS OF USA AND OTHER INDUSTRIALISED COUNTRIES

million cu.ft. p.a.

USA			
	1967	Total	270,000
		Merchant	43,000
W. Germany			
	1967	Total (1)	74,000
		Merchant	na
UK			
	1969	Total	63,650
		Merchant	8,150
France (2)			
	1967	Merchant	4,640 (3)

Sources-

(1) Total including estimates for captive tonnage uses

(2) Production figures. Source : French Official Statistics

(3) Defined as Compressed, excludes tonnage.

	1958	1966	growth rate 1958–66 % pa	1970	1975	growth rate 1970–75 % pa
Steel Industry						
Basic oxygen process	2.5	62.9	49.2	115.2	157.5	6.3
Open Hearth	10.3	62.7	25.3	54.9	41.8	-4.4
Electric and Bessemer	0.2	3.2	41.4	3.7	7.5	15.1
Blast furnace	5.9	9.0	5.4	10.0	12.0	3.7
Surface preparation	6.1	13.0	14.6	19.5	17.0	-2.5
Other burning and welding	1.1	2.1	8.4	2.2	2.4	1.7
Maintenance and other	2.0	2.3	1.8	2.4	2.6	1.6
	0.8	2.7	16.4	3.1	3.2	1.2
Steel industry total	28.9	162.9	22.3	211.0	244.0	2.8
Chemical industry						
Acetylene	6.6	38.0	21.4	44.2	51.4	3.0
Ammonia	9.5	13.1	4.1	18.6	24.0	5.2
Methanol	2.9	5.4	8.1	6.7	8.6	5.1
DMT Oxidation product	3.0	3.0	0.0	3.5	4.5	5.1
Ethylene Oxide	2.7	7.2	13.0	11.5	17.0	8.2
Titanium Dioxide	1.9	5.7	14.7	12.1	19.5	10.0
Others (incl. propylene oxide)	1.4	5.1	17.5	18.5	31.0	10.9
Chemical industry total	28.0	77.5	13.5	115.1	156.0	6.2
Metal government (including NASA)	1.5	8.5	24.1	9.1	11.4	4.6
Welding	1.4	2.3	6.4	2.9	3.9	6.0
Flame cutting	4.8	19.5	19.2	23.1	29.5	4.9
Others (including cement, glass industry and non-ferrous metals)	4.8	8.6	7.6	19.5	31.2	9.9
Grand Total	69.4	279.3	18.9	380.7	476.0	4.6

Source : Predicast Study No.45 The Cryogenics Gas Industry - July 1967

Note

The oxygen forecasts reproduced here were made in mid-1967 and prospects since have improved in many sectors, notably in steel, non-ferrous metals & chemicals.

The growth rates assumed for the 1970-75 period by a more recent forecast is substantially higher, which if fulfilled, would lead to total volumes 20% higher in 1975 than is shown in this table.

Steel industry, chemicals and non-ferrous metals oxygen consumption would, in this more optimistic case, be 23%, 38% and 100% higher respectively than shown in this Table. The reason for those differences is not clear and needs further investigation.

Further details about the penetration of oxygen in other industrial countries' steel industries, US prices of tonnage oxygen, specific consumption per ton of steel and the share of main suppliers in 1968 etc. are available in working paper form.

A 40333

U S A

Short tons per day

Type of Delivery	1957	1963	1967	1970	1972	1975
Merchant						
Liquid	265	1,665	3,585	6,025	7,725	9,450
Bulk Gas (Trailers)	70	45	60	75	85	100
Cylinder	60	55	40	30	30	30
Total Merchant	395	1,765	3,685	6,130	7,840	9,580
Tonnage						
Pipeline	20	2,640	5,105	na	na	na
Captive	80	665	1,460	na	na	na
Total Tonnage	100	3,305	6,565	11,850	17,050	24,250
Total All	495	5,110	10,250	17,980	24,890	33,830
Equivalent to thousand million cu. ft. per annum	4.9	50.3	101.0	175.0	245.0	336.0

Source : Unpublished report.

Comment : Various forecasts have been published for total nitrogen demand as follows :-

	Thousand Million cu.ft. pa.	
	1970	1975
CGA	200	420
Predicast	202.5	336
SRI	-	300
Unpublished report	178	336

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PAST TRENDS & FORECAST OF NITROGEN CONSUMPTION
BY TYPE OF DELIVERY 1957 - 1975
U S A

SECTION 4 (b(ii))
Table 12

Short tons per day

Type of Delivery	1957	1963	1967	1970	1972	1975
Merchant						
Liquid	265	1,665	3,585	6,025	7,725	9,450
Bulk Gas (Trailers)	70	45	60	75	85	100
Cylinder	60	55	40	30	30	30
Total Merchant	395	1,765	3,685	6,130	7,840	9,580
Tonnage						
Pipeline	20	2,660	5,105	na	na	na
Captive	80	685	1,460	na	na	na
Total Tonnage	100	3,345	6,565	11,350	17,050	24,250
Total All	495	5,110	10,250	17,480	24,890	33,830
Equivalent to thousand million cu. ft. per annum	4.9	50.3	101.0	175.0	245.0	336.0

Source : Unpublished report.

Comment : Various forecasts have been published for total nitrogen demand as follows :-

	Thousand Million cu.ft. pa.	
	1970	1975
CGA	200	420
Pre-ficast	202.5	336
SRI	-	300
Unpublished report	178	336

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Production	Shipments, including Interplant Transfers								
	Total			Shipped as Gas			Shipped as Liquid		
Thousand million cu.ft.	Quantity thousand mill.cu.ft.	Value $ million	Average Value $/000 cu.ft.	Quantity thousand mill.cu.ft.	Value $ million	Average Value $/000 cu.ft.	Quantity thousand mill.cu.ft.	Value $ million	Average Value $/000 cu.ft.
26.3	23.9	35.4	1.4	13.4	14.8	1.1	10.5	20.7	1.97
50.9	44.0	40.0	0.9	27.5	13.7	0.49	16.5	26.3	1.59
72.5	63.2	69.2	1.06	38.1	24.7	0.65	27.1	44.5	1.64
90.0	78.7	80.6	1.02	47.1	28.8	0.61	31.6	51.9	1.64
103.9	91.9	93.3	1.01	53.1	25.2	0.48	38.9	68.1	1.55
116.0	na	na	na	na	na	na	na	na	na
[illegible] month									
[illegible]	25.0	25.1	17.6	na	25.8	9.3	na	24.4	21.9

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Source: US Dept. of Commerce

CX-44-2-1

A 4037

SECTION 4 (b(ii))
Table 14

COMPARISON OF NITROGEN MARKETS OF USA AND OTHER INDUSTRIALISED COUNTRIES

million cu.ft. p.a.

USA (1)			
	1967	Total	116,000
		Merchant	56,500
W. Germany (2)			
	1967	Total	[illegible]
		Merchant	2,540
UK (3)			
	1968	Total	18,350
		Merchant	4,250
France (4)			
	1967	Total	1,230

Source:-

(1) US Department of Commerce

(2) Official W. German Statistics

(3) Total includes tonnage supplies. Estimate made within BOC

(4) Production figures, source French Official Statistics. Described as compressed, assumed to exclude tonnage.

Chemicals						
Manufacture of chemicals (1)	0.3	4.0	38.2	10.0	23.0	18.1
Inerting, drying, blanketing	1.8	21.0	35.9	55.0	92.0	10.3
Chemicals total	2.1	25.0	36.2	65.0	115.0	12.1
Aeronautics						
Space simulation	0.5	9.0	43.5	19.0	23.0	3.9
Other (2)	0.6	12.8	46.4	19.5	21.0	1.6
Aeronautics total	1.1	21.8	45.4	38.5	44.0	2.7
Food Industry						
Inerting	0.3	2.4	29.7	5.6	11.1	16.9
Freezing	-	1.0	-	3.3	9.6	23.7
In transit refrigeration	-	1.6	-	7.1	17.5	19.7
Food total	0.3	5.0	42.1	16.0	38.2	19.0
Laboratory						
Artificial insemination	0.012	0.080	26.4	0.120	0.175	7.9
Surgical and medical uses	-	0.006	-	0.021	0.044	16.0
Total	0.012	0.086	27.8	0.141	0.219	9.2
Metalworking (3)	1.7	13.5	29.7	25.4	36.6	7.6
Petroleum (4)	0.4	8.1	45.5	15.6	22.5	7.6
Electronics	0.7	14.1	45.5	34.2	63.0	13.0
Other uses (5)	0.2	3.6	45.5	7.7	17.0	19.4
Grand Total all uses	6.5	91.2	39.1	202.5	336.5	10.7

(1) Nitrogen used in ammonia production is excluded. Coverage is calcium cyanamide, hydrogen cyanide, melamine, nitrogen oxides metallic nitrides, wax, etc.

(2) Covers precooling, pressurising etc.

(3) Including annealing, carbonising, vacuum degassing, powdered metal fabrication etc.

(4) Includes oil well treatments, purging, testing, drilling muds, blanketing etc.

(5) Includes nuclear reactor cooling, glass making, pressure blasting of coal, helium extraction from natural gas etc.

A 4038

Source : Predicast Report no. 45 The Cryogenics Gas Industry, July 1967

duction	Shipments, including Interplant Transfers								
	Total			Shipped as Gas			Shipped as Liquid		
housand illion u.ft.	Quantity thousand mill.cu.ft.	Value $ million	Average Value $/000 cu.ft.	Quantity thousand mill.cu.ft.	Value $ million	Average Value $/000 cu.ft.	Quantity thousand mill.cu.ft.	Value $ million	Average Value $/000 cu.ft.
.7	.7	15.2	23.2	.2	8.6	42.0	.5	6.7	14.8
1.0	1.0	18.7	18.8	.3	9.7	38.8	.7	8.4	11.7
1.3	1.3	22.8	17.7	.3	11.6	37.2	1.0	11.2	11.5
1.7	1.7	26.7	15.6	.3	10.3	33.4	1.4	16.5	11.8
1.9	1.9	25.3	13.2	.3	9.3	31.6	1.6	16.0	9.9
19.2	18.2	8.8	-	7.0	1.3	-	21.4	15.6	-

urce: US Dept. of Commerce

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CX-44-Z-4

SECTION 4 (b(iii))

Table 17

COMPARISON OF ARGON MARKETS OF USA AND OTHER INDUSTRIALISED COUNTRIES

million cu.ft. p.a.

	Total
USA (1)	
1967	1,910
W. Germany (2)	
1967	198
UK (3)	
1968	225

Source:-

(1) US Department of Commerce - Total Shipments

(2) Estimate made within BOC, interpreting published official statistics for total 'rare gases'.

(3) Compressed and liquid sales by AP and BOC.

SECTION 4 (b(iii))

Table 18

USA - ARGON - END USE ANALYSIS TRENDS & FORECASTS 1958-1975

Argon used in welding	1958 mill. cu.ft.	1966 mill.cu.ft.	Actual Growth rate 1958-1966 % pa.	1970 mill.cu.ft.	1975 mill. cu.ft.	Forecast Growth rate 1970-1975 % pa.
Aircraft	126	492	18.5	790	1,050	5.9
Fabricated metals	80	344	20.0	535	850	9.7
Rockets & Missiles	15	115	28.0	270	290	1.4
Autos	20	65	18.0	110	170	9.0
Miscellaneous	44	131	17.5	175	250	7.9
Total	235	1,147	18.9	1,880	2,610	6.7
Argon used in non-welding applications						
Electronics	23	136	25.1	290	780	21.8
Aircraft and parts (1)	37	217	24.5	330	675	15.3
Iron and steel	9	55	25.3	90	130	7.6
Miscellaneous (2)	23	134	24.3	193	248	5.1
Total	92	542	24.9	903	1,833	15.1
Total Production	377	1,689	20.5	2,783	4,443	9.7

(1) Titanium production, wind tunnel research etc.

(2) Laboratory and research applications.

Source: Predicast Report no. 45 on The Cryogenics Gas Industry. July 1967

Note: Argon forecasts vary widely and total demand estimates range between 3,300 and 6,500 million cu.ft. for 1975

	Forecast for 1975 million cu.ft.
SRI	3,300
Predicasts ('67)	4,400
CGA (A.D.Little)	6,500
Unpublished report	5,000

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CX-44-2-5

SECTION 5

FUEL GASES

a General Review

b Acetylene

c LPG

d MAPP and Similar Fuel Gases

USA - FUEL GASES

General Review

The traditional fuel used for welding and cutting has been acetylene, either sold as DA or produced in 'on site' generators. Over the years substitute 'special fuels' have been suggested and particularly in the UK and later in Europe, propane has found acceptance except for welding.

In the USA the wide availability of piped natural gas at very low cost has influenced the choice of fuel gas; for example for cutting operations on fixed sites many companies use the natural gas. DA is primarily used in smaller establishments, or for site work, and in establishments where there is a mix of welding and cutting.

The use of propane (although a highly developed market for LPG exists see page 29) has never found wide acceptance in the USA as a cheap alternative to acetylene or natural gas, for example in cutting.

The marketing of 'special fuels' has always been regarded as bordering on confidence trickery until the advent of MAPP gas, where the same criticism was made by the industrial gas companies, nevertheless despite the near truths of the salesmen, the Dow claims had in one form or another sufficient force to convince a number of sophisticated users, one advantage being that the gas can be used for welding, unlike natural gas or propane.

More recently Air Products and Chemicals Inc. have introduced 'Apachi', understood to be primarily propylene and hence not a special fuel in the sense of MAPP. Nevertheless, the same marketing mechanism is said to be used by Air Products as was followed by DOW.

SECTION 5 (b)

ACETYLENE - USA

In the USA the largest proportion of acetylene is produced for chemicals manufacture and is made by captive plants.

Only some 18% of the total is used for welding and cutting purposes.

There are no official published statistics for dissolved acetylene (here interpreted also to include on-site generated acetylene) but some market estimates put total welding and cutting consumption at around 1,800 million cu.ft. for 1968, while others put it at nearly 3,000 million cu.ft. Some 25% of this is said to be on-site generation; again other estimates put it as high as 50%.

Taking the smaller estimate, the 25% on-site generation ratio would make the current market split as shown :

	1968 million cu.ft.
Merchant	1,350
On-site	450
	1,800

Forecast

The total DA market is said to be declining at the rate of 2.5 - 3%, pa, mostly under the impact of MAPP and LPG competition. Other year's figures are under evaluation.

Sources : Information received during visits to US, interpretation of calcium carbide end use analysis.

SECTION 5 (c)

L P G

Total LPG and ethane sales, analysis by end use

Use	% 1956	% 1967
Residential and commercial	45	43
Internal combustion	12	8
Industrial	7	)
Refinery fuel	2	) 4
Gas Manufacturing	3	1
Chemical	24	38
Synthetic rubber	6	5
Secondary recovery of petroleum	-	-
Other	1	1
	100	100

Sources: Handbook Butane-Propane Gases, Fourth Edition 1962
Butane - Propane News, Nov. 1968
" " " Jan. 1969

Between 1956 and 1967, total sales of LPG increased at 7.1% pa while industrial sales increased at 3.2%. Industrial plus refinery fuel sales decreased from 9% of total LPG sales to 4% between 1956 and 1965.

LPG Production Forecast (thousand tons per day)

	1968	1973 (est)	Rate grow
Production	162	196	3.8%
Consumption	158	194	4.2%
Surplus	4	2	

Source: Oil & Gas Journal 2.6.69

The surplus has caused some price weakening in the USA in 1968-9.

Distribution

The majority of LPG is distributed in bulk. Only small industrial users buy in cylinders.

LPG Bulk Stations, by size, 1962

Size thousand galls.	Number	Storage cap. thousand galls.	Method of servic Tank truck	Tank car	Ot
Under 25	348	5,549	304	43	
25 - 50	548	18,000	348	196	
50 - 100	142	9,353	77	63	
100 - 200	25	3,463	17	7	
Over 200	39	786,450	13	10	
Total	1,102	822,815	759	319	

Source: US Census of Business 1963 Vol.V, part 1

MAPP (METHYLACETYLENE/PROPADIENE)

MAPP was introduced in 1966 in the USA by Dow Chemical Co. By 1967 it had gained approximately 3.5% of the total merchant fuel gas market (acetylene, propane, natural gas). The main effect has been on cylinder acetylene and on site generated acetylene.

Sales of MAPP

Year	Sales (tons)
1962	42
1963	170
1964	350
1965	680
1966	1,250
1967	5,000
1970	17,000 estimated
1975	50,000 "

Note : The figures for 1970 and 1975 are Dow sales estimates and are probably on the high side. These estimates were made in 1967, but we have not been able to find more up to date information.

Current sales are divided 70% bulk and 30% cylinders spread over market sectors as follows :-

Use	% of total sales
Oxy-cutting	64%
Automobile welding, fusion and brazing	15%
Flame hardening	10%
Metallisation	10%
Welding	1%
	100%

Distribution

Direct from Dow to medium and large fuel gas users. Otherwise marketing is through a chain of 128 distributors operating 200 stores. It is planned to double the number of distributors.

Dow Chemical Company intend to market MAPP in the UK and Europe.

In early 1969 Air Reduction acquired the MAPP Gas Business of the Dow Chemical Co. (Welding Journal, May 1969)

Sources : Report of visit to the USA, 21.6.66
"The Market for MAPP Gas" MR/110/21

Report on MAPP - WHR/FCW/VC
Visit to Dow Chemical Company, 15.10.64.

SECTION 6

CARBON DIOXIDE

Production (Thousand Short tons)			Shipments, including Interplant Transfers: Quantity (000 short tons)			Value ($ million)			Average Value ($/short ton)		
Total	Solid (dry ice)	Liquid & Gas	Total	Solid (dry ice)	Liquid & Gas	Total	Solid (dry ice)	Liquid & Gas	Total	Solid (dry ice)	Liquid & Gas
826.9	448.1	378.3	759.6	437.4	322.2	48.5	24.7	23.8	63.8	56.4	73.8
976.7	434.2	542.5	877.9	414.5	463.4	48.9	21.1	27.8	55.7	50.9	59.9
1,088.8	421.1	664.7	971.9	417.1	554.8	52.7	22.4	30.3	54.2	53.7	54.6
1,041.8	379.0	702.8	948.0	362.0	586.0	50.1	19.0	31.2	52.8	52.4	53.2
1,089.3	368.1	717.2	971.4	352.5	618.9	47.4	18.1	29.4	48.7	51.3	47.5
1,048.0	363.0	658.0	na	na	na	na	na	na	na	na	na
4.60	-2.80	11.2	4.20	-2.94	11.5	0.33	-4.06	3.51	-	-	-

Source: US Dept. of Commerce
Current Industrial Reports M28C

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A 4049

SECTION 6

Table 20

USA - CARBON DIOXIDE FORECASTS

	Growth rate % pa	Forecast Thousands short tons 1974	1975
CGA	8	-	2,500
SRI	4	-	1,700
Chemical and Engineering News (1) Solid	2	440	-
Liquid & Gas	8	1,230	
		1,670	

1970 407 905 1312

(1) 25th August 1969 Issue - Forecast for 1974

Comment

As these figures indicate, when compared with past trends, an acceleration is expected - in fact the reversal of decline in the case of solid CO_2. The overall growth is mostly due to increased chemical industry, metal fabrication, fire protection and greenhouse fertilisation uses.

Cx-44-2-14

SECTION 6

Table 21

CARBON DIOXIDE

USA - Comparison of demand with other industrial countries 19

			Thousands Short Tons
USA 1967	Solid		330
	Liquid and gas		620
		Total	950
West Germany		Total	90
Italy		Total	36
France		Total	38
UK		Total	181

Source : SRI Draft Report on Industrial Gase
Western Europe - September 1969

Comment The relatively large figure for the UK is due to
nuclear coolant applications here, a use largely
absent in other countries.

CX-44-2-15

A 4051

SECTION 6
Table 22

CARBON DIOXIDE END USE ANALYSIS

	%
Refrigeration	45
Carbonisation	21
Chemicals	10
Welding	5
Miscellaneous	19
	100

Source: SRI 1966

End uses said to be diversifying rapidly.
New applications include aerosol propellants and greenhouse fertilisation but most of all, chemical industry uses.

CY-44-2-16

A 4052

SECTION 7

HYDROGEN

USA - HYDROGEN PRODUCTION AND SHIPMENTS

	Production			Shipments, including Interplant Transfers								
	Thousand million cu.ft.			Quantity thousand mill. cu.ft.			Value ($ million)			Average Value ($/,000 cu.ft.)		
	(1) Total	High(2) Purity	Lower(3) Purity	(1) Total	High(2) Purity	Lower(3) Purity	(1) Total	High(2) Purity	Lower(3) Purity	(1) Total	High(2) Purity	Lower(3) Purity
1961	65.2	13.5	51.8	11.6	8.1	3.5	11.4	10.1	1.2	0.98	1.24	0.35
1963	95.6	22.7	73.0	19.9	15.7	4.3	25.7	24.6	1.1	1.29	1.56	0.26
1965	121.6	30.1	91.5	26.0	22.9	3.2	37.4	37.4	1.0	1.43	1.63	0.32
1967	137.7	35.5	102.2	30.6	27.9	2.8	43.0	42.1	0.9	1.40	1.50	0.32
1968	157.9	34.1	123.8	27.5	25.6	2.0	37.0	36.3	0.7	1.78	1.41	0.34
1969	na	33.5	na	na	na	na	na	na	na	na	na	na
Average growth rate 1961-7	15.7	16.6	15.6	16.1	21.1	-6.1	21.6	23.8	-5.9	-	-	-

(1) Including high purity (99.5% - 100%) and lower purities. Total may not add due to rounding.

(2) This table does not coincide with the definitions in section 2 of this report.

High purity (99.5-100%) hydrogen statistics exclude captive refinery uses and quantities produced and consumed in the manufacture of methanol and ammonia. They include interplant transfers for sale for ammonia production.

There is a further breakdown on high purity hydrogen production by (1) electrolytic and (2) other processes also available (see working paper 10(/7).

(3) Lower purity hydrogen (less than 99.5% on 100% basis).

Excludes amounts vented, used as fuel, etc, and amounts produced and consumed in the manufacture of synthetic ammonia and methanol, but includes an unspecified amount produced for sale or interplant transfer to plants consuming this gas in the production of ammonia. Also excludes amounts produced by the ammonia process (cracking of ammonia). Includes amounts of hydrogen produced by some, but not all, petroleum refineries producing hydrogen from catalytic reforming operations.

Some 70-75% of lower purity hydrogen consumption was accounted for by petroleum refinery captive use.

Source: US Dept of Commerce
Current Industrial Series 1969

A-4053
CX-44-2-17

HYDROGEN - END USE ANALYSIS

A recent (mid 1969) estimate shows the current end uses for merchant hydrogen.

	%
Electronics	26
Chemicals	25
Aerospace	10
Hydrogenation	9
Metallurgical	9
Miscellaneous	21

There are wide fluctuations in this pattern; in 1966, for example, NASA is said to have accounted for one third of total high purity production.

There are no published figures for liquid hydrogen. One source (CGA) puts it as high as one third of high purity production in 1966, which would mean a liquid hydrogen figure of some 12,000 million cu.ft. In 1962 NASA consumption was said to be 15,000 million cu.ft. (Predicast, 1964).

In 1967 known liquid hydrogen production capacity was 38,500 million cu.ft. pa. but this figure assumes a 100% utilisation. There were some 10 plants in operation, three of them at or near NASA facilities.

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A 4056

SECTION 8

CARBON MONOXIDE

CX-44-2-21

SECTION 8

CARBON MONOXIDE

In recent years the cryogenic separation of carbon monoxide has been put into commercial practice.

So far there are only two known examples for this process and there are no available statistics on production.

Air Products & Chemicals Inc. recover carbon monoxide from the feedstock generated by steam reforming methane and separates 98% pure carbon monoxide from hydrogen. The plant is located at Houston, Texas and the carbon monoxide is delivered by pipeline as an intermediate step in making isocyanates for urathane foam. The plant has an estimated carbon monoxide capacity of 25,000 tons per year.

American Air Liquids Inc. was awarded a one million dollar contract for the construction of an 80,000 tons per year cryogenic carbon monoxide plant by Monsanto Chemicals at Texas City. The plant separates carbon monoxide from steam reformed natural gas feedstock.

It is also known that Cosmodyne has built road tankers for the transportation of liquid carbon monoxide.

HELIUM

CK-44-2-23

A 4059

Section 9
Table 24

USA - TRENDS AND FORECASTS OF HELIUM CONSUMPTION
1960 - 1975

HELIUM CONSUMPTION FEDERAL AND NONFEDERAL BY END-USE

(million cubic feet)

ITEM	1960	1965	1970	1975
Federal Government:				
Rockets & Missiles	230	315	350	370
Research & Testing	28	43	105	160
Welding	25	30	25	25
Nuclear Reactors	32	29	30	40
Aerology	25	27	30	30
Electronics	10	17	50	90
Medicine	7	13	35	50
Other	3	5	20	35
TOTAL	360	479	645	800
Private Industry:				
Research & Testing	35	120	350	510
Welding	60	83	145	210
Nuclear Reactors	3	11	29	62
Aerology	2	2	2	2
Electronics	8	38	124	210
Medicine	5	14	51	100
Other	2	10	29	46
TOTAL	115	278	730	1140
ALL USES:				
Rockets & Missiles	230	315	350	370
Research & Testing	63	163	455	670
Welding	85	113	170	235
Nuclear Reactors	35	40	59	102
Aerology	27	29	32	32
Electronics	18	55	174	300
Medicine	12	27	86	150
Other	5	15	49	81
TOTAL	475	757	1375	1940

Source : Predicast Report No. 45 on
Cryogenic Gas Industry - July 1967

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A 4060

TRENDS AND FORECASTS OF USA HELIUM DEMAND

Million cu.ft.

	Actual			Estimated
	1965	1966	1967	1975
Conservation programme	3,550	3,617	3,619	3,500
Space and other federal uses	479	507	419	800
Private industry	278	441	488	1,140
Total demand	4,307	4,565	4,526	5,440

Sources: US Bureau of Mines,
Predicast 1967

The maximum annual figure that the Bureau of Mine is authorised to spend on helium conservation is $47.5 million year until 1985.

The four companies on contract are Northern Helex, Cities Service Helium, National Helium and Phillips Petroleum and they receive prices ranging between $10.30 and $11.78 per 1,000 cu.ft. from the Bureau of Mines.

The selling price to private users by the Bureau of Mines is $35.0 per 1,000 cu.ft. but private suppliers sell well below these prices, which currently average $25 per 1,000 cu.ft. They are forecast to fall to around $17 by 1975.

CX-44-Z-25

Section 9
Table 26

SUPPLY PATTERN OF USA HELIUM MARKET

million cu.ft.

	1960	1966	Forecast 1970	1975
US Bureau of Mines				
Shipments	475	809	850	880
Private industry	nil	139	525	1,060
	475	948	1,375	1,940
Value of sales $ million	7.8	31.8	40.3	48.8

Source : Predicast 1967

Comment :

This table reflects supply pattern for current consumption - ie excluding conservation programme demand. The increasing importance of private suppliers reflects their lower selling prices as a result of cost cutting by shipping liquid for lower transport costs.

CX.44-2-26

Section 9
Table 27

USA HELIUM CONSUMPTION FORECASTS

		Million cu.ft. 1975	Growth rate % pa 1965 - 1975
SRI (1)		1,800 (2)	9
Predicast (3)			
Federal	800		5.3
Private	1,140		15.2
Total		1,940	9.9
CGA (4)		1,700	7.0

(1) SRI Industrial Gases Report No. 289, July 1966

(2) Civilian uses

(3) Predicast report in Cryogenic Gas Industry No.45 July 1967

(4) The future of the Compressed Gases Industry, CGA, January 1968

CK-44-Z-27

Section 9
Table 28

USA - END USE ANALYSIS OF HELIUM CONSUMPTION

1967

A further, more detailed breakdown on helium utilisation in 1967 is given in the following Table.

	Percent	Volume Mill.cu.ft.
Purging and Pressurizing	40.8	370
Controlled Atmosphere	11.6	105
Research	11.1	101
Welding	10.7	97
Lifting Gas	7.6	69
Leak Detection	7.1	64
Cryogenics	5.6	51
Chromatography	2.4	22
Heat Transfer	1.6	14
Synthetic Breathing Mixtures	0.2	2
Medical	0.2	2
Tracer	0.2	2
Other	0.9	8
Total	100.0	907

Source : Cryogenic Engineering News October 1968.

CX-44-Z-28

Section 9
Table 29

USA - END USE ANALYSIS OF HELIUM CONSUMPTION OF FEDERAL AGENCIES

Million cu.ft.

Agency	1964	1965	1966
Department of Defense	347.3	313.2	232.9
Atomic Energy Commission	64.8	59.9	52.9
NASA	79.7	99.9	214.7
Weather Bureau	7.0	5.6	5.8
Other	.6	.5	.6
	499.4	479.1	506.9

Source : Predicast Report No. 45 on Cryogenic Gas Industry - July 1967

A 4065

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LIQUID HELIUM

Most of liquid helium is used for research purposes, including superconductivity.

Liquid helium consumption in the USA increased from 4.7 million cu.ft. in 1962 to 47.1 million cu.ft. in 1967, an average growth rate of 58% pa.

Total R & D applications are forecast to reach 670 million cu.ft. by 1975,(Predicast) compared with 163 million cu.ft.in 1965, representing a growth rate of 15.2% pa; it is not known however, what proportion of this will be in liquid form.

CX-44-2-30

A 4066

SECTION 10

USA - INDUSTRIAL GASES MARKET - SOME ASPECTS REVIEWED

a Major industrial gas manufacturing firms - product analysis

b General
Tonnage
Steel
Non-ferrous metals
Chemicals
Merchant Market
Distributors
Pricing policies
Position of Independents

MAJOR INDUSTRIAL GAS MANUFACTURING FIRMS - PRODUCT ANALYSIS

US $ millions

Most Important Note : Many of these figures have been estimated within BOC (drawing on a variety of fragments of information).

	Total net sales	Industrial Gases	Welding Equipment	Cryogenic Equipment	Chemicals & Catalysts	Medical Gases & Supplies	Others	Figures apply to year ended
Airco	438	115 (e)	72	6 (e)	132 (4)	24	89 (5)	31.12.68.
Air Products & Chemicals	183	95 (e)	16	19	33	4 (e)	14 (3)	30. 9.67.
American Cryogenics	50 (e)(6)	40 (e)	10 (e)	-	-	-	-	1968
Big Three	47	30.5 (e)	15 (9)	-	-	-	1.5 (10)	31.12.68.
Burdett Oxygen	13.7	9.0 (e)	2.0 (e)	-	-	2.7(e)	-	2. 2.69.
Chemetron	237.5	121 (8)	-	-	39.5	na	47 (7)	31.12.68.
Linde Cryogenic Division	83 (11)	55 (11)	-	-	-	-	-	1966
Union Carbide (Linde Division)	2,686	200	144 (e)	30 (e)	927 (1)	-	1,385 (2)	31.12.68.

(1) Includes £184 million carbon products.

(2) Includes plastics £374 million
metals £369 million
materials systems £72 million
electronics £36 million
consumer & related products £534 million

(3) Includes licensing & services £9 million
construction £5 million

(4) Including £80 million carbon, graphite and electronic products

(5) Ferro alloys and metals

(6) Figure estimated, includes related products. Total turnover (estimated) £50 million for 1968. Includes Industrial Air Products £17 million and Dye Oxygen £5 million sales.

(7) Metal products and process equipment

(8) Includes medical gas and related products

(9) Includes medical equipment

(10) Oil well servicing

(11) Figures relate to 1966

(e) Estimated within BOC

na Not available

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Comment : The figures relate to global sales as given in company annual reports. It is known that many of the above companies have substantial operations outside the USA.

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CX-44-2-31

A 4068

SECTION 10 (b)

USA - INDUSTRIAL GASES MARKET
SOME ASPECTS REVIEWED

GENERAL

This is a small industry in which, nevertheless, the leading participants are large firms:-

Approximate recent annual turnover of:	$thousand million
USA Industrial Gas Industry *	0.7 (plus)
All Chemical Industries in the USA	42.4
USA Steel Industry	18.4
* of which three firms (UC Linde, Airco & AP Inc) are estimated to provide	0.4 (60% approx.)

It is a highly capital intensive industry:-

	+Airco	+ AP & C Inc.	for comparison +BOC
Ratio: average capital employed/sales	0.98	1.3	1.09
Capital employed per person employed ($000)	30.1	35.4	11.1

+ includes all activities, not just gases, Similar figures for UC Linde not available.

Profitability is, in general, poor; but AP & C Inc. - as well as some of the "independents" and some distributors - now make profits which are good by the standards of capital intensive industry, and their growth record is good.

Prior to the early 1960's the growth in the industrial gas market had been steady but not spectacular (see table No.6.).

In the early 1960s two things of prime importance happened to the industrial gas industry. They were the introduction of LD steel and the American space effort in the shape of NASA.

The impact of these two events, coming more or less simultaneously, created a demand for ASUs with large liquid capacity - the gas for use in the LDs and the liquid for NASA and for other companies seeking low temperature know-how as sub-contractors to NASA. Where liquid was not available, liquefiers were quickly added. MARKET SHARES, as they are currently interpreted are shown in Section 10 (a).

TONNAGE

Generally up to the early 1960s the practice in the USA had been to put down an ASU where a market existed, and to add a liquefier as and when necessary. With the growth described above a rash of plants were put down speculatively to cover the expected demand. A certain amount of rationalisation took place, with the closing of smaller units and the distribution of cheap liquid from the large plants by road, sometimes by rail, to works that now became distribution centres. UC Linde led

the way on this. As examples Airco closed their factory at Philadelphia, Pa. when the large tonnage plant at Claymont Delaware came on stream in 1962, and similarly Union Carbide closed their unit at Berkeley, Cal., when their Pittsburgh, Cal., plant came on stream in 1960.

The justification for these speculative plants was normally based on an intensive market research effort beforehand.

(The fallibility of the policy was demonstrated, however, to the 1967 BOC mission - internal document No. 7 in that the AIRCO 1,000 tpd plant at New Orleans was only running at 100 tpd following the loss of the Mississippi Rocket Test Facility liquid contracts to AP & C Inc. who had also put down a large plant in New Orleans).

The current situation seems to be that a base load for the gas off a plant is considered essential before any new plant is entertained. ie as a recent example AP have a supply scheme in West Virginia to two chemical companies. In their press release they state that the scheme has provision for future pipeline supply of gases to other firms in the Ohio River Valley.

STEEL

The first steelworks on-site oxygen plant of any substantial size, also the first appearance of AP Inc. as a rising force in the industry, was in 1946 at Weirton, West Virginia; the plants had been built for the Russians, but became available as frustrated exports when the American Government stopped "Lease-lend".

1954 saw Helbuth Steel introduce the first major LD steel facility to the USA, buying a Linde AG ASU which they operated themselves.

Subsequently, however, the steel companies installing LD capacity used the supply facilities offered by Linde UC and AP, and later by AIRCO and others. In consequence the American steel industry buys most (86% in 1967) of its tonnage oxygen under supply scheme arrangements with long-term, mainly 15 year, agreements.

It should be realised that at this time only AP and UC Linde had the capability to make and install ASUs - that is of the American industrial gas companies. There were two other companies outside the industry who also had the capability, namely Hydrocarbon Research Inc., and the company that is now called Process Plant Corp.

What is not clear is why the steel companies did not buy their own plants. The attractions of supply schemes are well understood, including the old argument on making the best use of the capital available. Also, the process itself may have appeared unfamiliar to them.

Tonnage facilities have grown. Today the combined capacities at UC Linde's Gary, Indiana and East Chicago plants - which are interlinked by a pipeline - is of the order of 6,000 tpd GO supplying Inland steel - 1,400 tpd, Republic steel - 1,300 tpd and 1,000 tpd (at two sites), Youngstown Sheet and Tube Corp. - 625 tpd, and some oxygen to Universal Atlas Cement. It also has available 1,000 tpd of LO/LN for the merchant market. This is probably the largest complex of its kind in the world.

CX-44-2-34

A 4070

NON-FERROUS METALS

The use of oxygen in the non-ferrous industry in the USA is still very much in its infancy. Only two companies have oxygen supply schemes at the present. Future development, following "Chilenisation" of American interests in Chile, may well herlad a demand for increased home production, leading to an oxygen requirement.

CHEMICALS

Oxygen, in the eyes of the chemical industry, is just another raw material. Whilst a steel company might consider it did not have the capability to run an oxygen plant, similar considerations have not bothered the American chemical interests. This has meant that the majority of plants have been sold outright to chemical firms for some specific purpose. Nevertheless speculative industrial gas complexes have been put down by the major gas firms so that gas at a low price has become available. For example Union Carbide has a complex at Deer Park, Texas. Originally it was built to supply the 10 units of basic steel; with this as base load, Diamond Alkali and Humble Oil were brought onto a grid. This drift by chemical concerns to supply schemes as opposed to purchase is apparent in other instances in the USA; the Oil and Gas Journal, December 16, 1968 carries an article on Big Three's development in Texas and its pipeline supplying the petrochemical industry - this is available as a working paper, (No. 133).

Considerations on the siting of tonnage facilities and indeed other chemical facilities in the USA are believed to be influenced by the Government and State grants that are offered, also the cost of electricity. Both can vary considerably from state to state.

MERCHANT MARKET

Most of our knowledge is based on the 1965 and 1967 BOC missions to AP&C. It is obvious that they and Linde and AP & C Inc. have followed similar patterns of trading.

The method of operation is to distribute liquid from large plants sometimes over a territory of a radius of about 300 to 600 miles either to company-owned depots or to distributors, by road and rail tank cars.

The maps in the appendix show known locations of the "Big League" Tonnage facilities.

Rail distribution in the USA is slow and unreliable - that is when one has to use more than one railroad company. However, use of rail can be attractive; Burdett Oxygen quoted recently a break-even point of about a hundred mile haul against road transport.

Linde UC have many "old-type" VIT's in railcars which they use over a wide area; but it is believed that they are uneconomic because of heavy losses and slow transportation.

The advent of the space programme had called for a massive investment by the industrial gas companies in road tankers not only to supply NASA, but later also distributors and other liquid customers. Now that the NASA programme has "levelled off" there is a surplus of not only liquid but also hardware, in the shape of road tankers and VIPs etc.

BEST COPY AVAILABLE

VIEs and VITs range from 30,000 cu.ft. capacity to 1700,000 cu.ft. capacity. What is not clear from the information available is the pattern of usage and the smaller "LC3 type" liquid vessels which are still in use.

Leasing of road and rail tankers is common practice in the USA (see working paper No. 7). In addition to the finance companies, Cosmodyne - probably the leading cryogenic tanker manufacturer - have been operating a lease fleet since the early 1960s.

DISTRIBUTORS

The major manufacturers distribute the bulk of their compressed gases, as well as welding and cutting equipment, through a network of distributors.

AIRCO have some 400 distributors, of which 60 are major distributors, who have liquid storage and pump cylinder filling facilities. Small distributors can also obtain supplies from a major distributor.

Approximately 80% (volume) of AIRCO's cylinder gas business is handled by distributors. AIRCO's ultimate aim is for the distributors to handle all the cylinder business including trailers.

Distributors are autonomous. The company is prevented from participating in the equity by Federal laws, though AIRCO have sponsored employees who wish to set up on their own, thus obliquely securing a tied outlet. Supplier and distributors often have a formal agreement; but it is limited, by law, to one year's duration.

Distributors operate their own transport for delivery to their customers, but many customers collect. Some distributors operate a compressing station into which the supplier delivers liquid; the station equipment may be bought or hired from the supplier and generally the supplier's "know-how" is provided to the distributor.

Distributors fix their own selling price, and a strong competitive position usually dictates lowest possible levels. AIRCO's national customers, when operating in a distributor's territory and taking less than half a truck load per delivery, are referred to a distributor who will probably fix his own price in relation to the local "market-place".

AIRCO have it "fully understood" that they take customers away from a distributor once demand warrants a liquid installation.

Broadly speaking a customer will stay on cylinders until his demand reaches 24,000 cu.ft. a month, at which stage he is put onto "trailers", is similar to BOC hydrogen trailer but in the USA used for other gases. AIRCO's standard trailer has a 125,000 cu.ft. capacity. The liquid threshold is of the order of 400,000 cu.ft. per month, very much higher than in the UK. Obviously these are guideline figures since location, distance from works, and competitive situation all play a part. It seems impossible to generalise about the level of storage that customers require and that they get. The smallest size of VIE in common use is much larger than in the UK; larger volume cylinder customers often receive cylinders in bundles, in the continental European style.

AIRCO operate retail depots where suitable distributors cannot be found, or where a distributor may be bought out by a competitor or decline to renew his contract - normally only 30 days - with AIRCO.

. In 1967 the BOC mission to AIRCO were told that a distributor was expected to make a 6-8% net profit after paying all costs.

PRICING POLICIES

Price competition is genuine subject to the limits imposed by Federal Trade laws.

Each production facility tends to have its own price structure, and as such is more or less an independent unit.

A BOC visitor to AIRCO in January, 1969 was told that their price of product from a centre was costed as follows : -

a product 'value' by location, being equivalent to incremental electricity charges

b remaining direct plant cost, plus depreciation and plant overhead, plus profit

c station increment of 1.5% on capital

d distribution cost

e general and administration charges for the region and head office

Total gives minimum price

This table is used to calculate what is in effect the 'schedule'. Shading below this price is most extensive when a plant is lightly loaded, that is, running at a capacity of between 50 and 60%.

Once this happens it is considered essential to get the business whatever the competition. To do this, a price is quoted based on (a) and (d); in other words, simple incremental electricity plus direct distribution cost. Generally speaking, once a plant is backed up to about 80% capacity, a more selective attitude is adopted.

Prior to 1968 most CIE equipment had been offered to customers on "free loan". In 1968 Linde UC and also AIRCO introduced a "Facility Charge - to pass onto customers a portion of the investment". Nevertheless, the impression remains that progress towards more sophisticated tariff schemes, to minimise cross-subsidies between customers, is slow. The 30-day "free" period for cylinders, with a "demurrage" rental thereafter, remains in general use.

W E Ford - Gases Division - attended the April 1969 Safety Symposium of the CGA. His report contains the following statement:

> "There are problems due to the very keen competition in the 'States and low prices leading to narrow margins. The whole problem of the number of companies and trading positions seems to be of general concern and was expressed by members of other companies at Chicago. There is a feeling that mergers must follow with price increases to revive the industry!"

It is of interest that AIRCO raised prices of O_2 and N_2 by about 10% in July 1969 following similar action by other major industrial gas producers. Prices of other gases were raised on 1 September, 1969.

A similar price rise in 1968 met with little success in that the increases didn't hold - not because they weren't needed, but because none of the companies could stand to lose their share of the market. A recent BOC visitor to the USA tells us that AIRCO are currently leading a price war and Linde UC have followed - this may indicate a similar situation developing again.

POSITION OF THE INDEPENDENTS

We know very little about the role of the "independents" in the American Industrial Gas Market.

That they are able to compete and survive against the distribution network of the "Big League" is apparent from the tables in Section 11.

Hearsay evidence of independents buying liquid from the "Majors", when it is convenient, are probably true. It is standard practice for the "Majors" to trade liquid among themselves, and if a big plant breaks down the operator will, as a matter of accepted course, canvass his competitors for emergency supplies.

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SECTION 11

INDUSTRIAL GAS COMPANY PROFILES

a Major USA Industrial Gas Companies

b Other Manufacturers of Industrial Gases

c Distributors

d Company Acquisitions 1946-1969

e R & D - some comments

SECTION 11 (n)

MAJOR USA INDUSTRIAL GAS COMPANIES

SECTION 11 (a)

MAJOR USA INDUSTRIAL GAS COMPANIES

The following Tables 31 and 32 set out financial summaries and analyses of the eight largest companies operating in the American industrial gas field.

Houston Natural Gas is included by virtue of its holding of Liquid Carbonic but incidentally provides comparison with the financial advantages of high gearing and low working capital enjoyed by Utilities.

Industrial Air Products (alone of the L'Air Liquide 1969 American acquisitions for which full accounts were available) is included. Together with American Cryogenics and Dye Oxygen, IAP brings L'Air Liquide investment and turnover in USA to approximately $50 million, now similar in size to Big Three.

The following are general comments:

1 Profitability

Return on capital is mediocre in all eight companies with Big Three's 13.5% as the highest. However, the effect of the high level of retentions by Houston Natural Gas, Big Three and Air Products combined with their higher gearing explains the good record in earnings per share annual growth of 13 - 18% achieved by these three companies over the last 5 years.

Big Three has the best record with an annual EPS growth rate of 18% over the last five years. Burdett, on the basis of the 1969 result has the worst, with pre-tax return of 3.1%, post tax return on equity of .01% and EPS decline over 5 years of 17% per annum. Borrowings at 70% of capital employed and high level of trade creditors outstanding suggests a critical financial situation. The $8 million short term loans raised for Niagara and Joliet developments have since been funded into 15 year term finance with the Prudential Insurance Company. The 10% price increases of July/September 1969 are expected to restore margins.

2 Capital Expenditure

Burdett and Big Three had the highest level of capital expenditure at 40% and 30% of net fixed assets.

3 Leased Assets

Airco, Chemitron, AP, IAP and Burdett have leased assets excluded from their balance sheet assets. The highest are Airco and Burdett with an estimated additional 30% and 37% respectively, of net fixed assets, in leased form.

4 Research and Development

R & D expenditure was only available for Union Carbide, Airco and Air Products and represented 3.2 - 3.8% of operating costs.

[illegible] INDUSTRIAL GAS COMPANIES - FINANCIAL SUMMARY

	UNION CARBIDE	AIRCO	HOUSTON NATURAL GAS	CHEMETRON	AIR PRODUCTS	BIG THREE	INDUSTRIAL AIR PRODUCTS	BURDETT OXYGEN
Year ending	31.12.68.	31.12.68.	31.7.68.	31.12.68.	30.9.67.	31.12.68.	31.1.69.	28.2.69.
	$	$	$	$	$	$	$	$
	% million	% million	% million	% million	% million	% million	% million	% million
Balance Sheet								
Net Fixed Assets	65 1,811	67 291	93 202	53 115	82 220	85 58	64 9	83 19
Investments	2 53	1 5	1 4	13 28	2 4	3 2	- -	- -
Net Current Assets	33 921	32 140	6 12	34 72	16 44	12 7	36 5	17 4
Capital Employed	100 2,785	100 436	100 218	100 215	100 268	100 67	100 14	100 23
Source of Funds								
Equity	60 1,669	53 233	29 63	63 135	46 121.5	49 30	57 8	30 7
Preference	- -	- -	7 15	1 1	- .2	- -	- -	- -
Minorities	3 79	- -	- -	- -	- -	- -	- -	- -
Loans	36 997	35 152	56 121	20 61	42 115.2	48 29	36 5	70 16
Overdrafts	1 40	12 51	6 19	3 18	12 33	3 2	7 1	- -
Deferred Taxation								
Capital Employed	100 2,785	100 436	100 218	100 215	100 268	100 61	100 14	100 23
Estimated Capitalisation of Leased Equipment	-	86 *	NA	7	57	NA	.3	7
Profit and Loss Account								
Sales	100 2,686	100 438	100 313	100 258	100 202	100 47	100 17	100 14
Trading Profit	20 538	14 60.3	11 34.5	11 27	22 44.4	27 12.5	16 2.8	8 1.153
Other Income (add)	2	2.5	.7	6.5	2.7	.4	.2	.866
Current Items	231	24.9	9.2	12.9	17.8	5.3	1.3	1.432
	11 305	9 37.7	0 26.0	9 20.6	15 29.3	16 7.6	10 1.7	4 .587
Profit (pre-tax, pre-interest)	43	7.9	6.2	3.5	7.1	1.5	.4	.721
Interest	263	.8	19.8	17.1	22.2	6.1	1.3	.066
Profit (pre-tax)	97	10.4	6.8	8.4	10.5	2.3	.5	.014
Tax	10	-	-	-	-	-	-	-
Minorities	-	-	.7	.1	1.1	-	-	-
Preferential Dividend								
Equity in affiliated earnings (add)	1	-	-	1.5	-	.2	-	-
Earnings (Equity)	6 157	4 19.4	3 10.3	4 10.1	5 10.6	9 4.0	5 .8	.053
	121	16.6	4.0	6.5	.9	1.0	-	.048
Dividends	-	-	-	-	3.4	-	-	-
Stock Dividend (AP)	36	2.8	6.3	3.6	9.7	2.2	.8	.004
Cash Retentions								

NOTES : * Airco's capitalisation of leased assets above includes approximately $30 million in tonnage plants.

$ Burdett Oxygen borrowing includes the $3 million short-term bank loan raised in 1968 for construction of facilities at Niagra Falls, NY and Joliet, Illinois.

57% of Burdett Oxygen equity is owned by the Loveman family; 60% of Big Three equity is closely held.

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MAJOR USA INDUSTRIAL GAS COMPANIES - FINANCIAL ANALYSIS

Year end	UNION CARBIDE 31.12.68.	AIRCO 31.12.68.	HOUSTON NATURAL GAS 31. 7.68.	CHEMETRON 31.12.68.	AIR PRODUCTS 30. 9.68.	BIG THREE 31.12.68.	INDUSTRIAL AIR (MICHIGAN) 31. 1.69.	MATHESON CO. INC. 30. 7.68.
Return on av. Capital Employed (pre-tax, pre-interest)	11.1%	3.8%	17.4%	9.9%	11.0%	13.5%	18.1%	3.1%
Profit/Sales	11.4%	8.6%	8.7%	9.7%	14.3%	16.2%	10.0%	4.3%
Sales/Average Capital Employed	.98	1.00	1.48	1.15	.7%	.84	1.3	.7%
Working Capital/Sales	34%	32%	4%	30%	22%	15%	28%	23%
Current Assets/Sales	49%	44%	8%	39%	43%	32%	40%	32%
Stocks/Sales	23%	22%	1%	21%	10%	12%	19%	29%
Debtors/Sales	18%	17%	4%	14%	24%	12%	17%	8%
Creditors/Operating Costs	6%	8%	5%	9%	17%	22%	9%	20%
Net Fixed Assets/Sales	67%	66%	62%	48%	109%	111%	56%	137%
Debtors/Net Fixed Assets	13%	9%	5%	11%	8%	10%	14%	8%
Fixed asset expenditure/Net Fixed Assets	19%	11%	12%	19%	16%	30%	15%	43%
Debt Based Capitalisation/Net Fixed Assets	-	30%	NA	6%	26%	NA	3%	37%
Market value of Equity (Year's mid-price) $ million	$1,7	350	852	165	197	93	20 (1)	15
Equity assets $ million	1,6xx	253	63	135	122	30	8	7
Market valuation on Equity Assets	6%	34%	600% book	21%	62%	310% book	250% book	214% book
P/E ratio	17.4	17.4	34.4	16.2	18.6	23.1	25.3	- (2)
Dividend cover	1.3	1.9	2.6	1.6	11.8	2.3	No Dist.	1.1
Return on Equity Funds (post tax)	9.4%	5.4%	16.4%	7.5%	8.7%	13.4%	9.8%	.01%
Sales growth (average annual rate)								
Last year	6%	6%	14%	3%	10%	6%	10%	16%
Last 3 years	10%	7%	15%	9%	14%	15%	Na	14%
Last 5 years	6%	9%	11%	7%	17%	12%	NA	9%
Earnings per share Growth (average annual rate)								
Last year	/\7%	/\3%	6%	/\4%	8%	Same	7%	/\12%
Last 3 years	/\7%	1 %	15%	5%	11%	10%	Na	/\12%
Last 5 years	/\7%	/\7%	15%	10%	20%	20%	NA	/\
Employees	114,700	14,201	1,478	8,073	7,500	908	390	395
Sales per employee $'000	24	31	212	30	27	52	44	35
Average Capital Employed per employee $'000	24	30	144	26	35	62	36	47
R and D percentage of operating costs	3.8%	3.3%	NA	NA	3.2%	NA	NA	NA

NOTE : (1) Represents price of acquisition of IAP in June 1969 by L'Air Liquide through American Cryogenics. IAP obtained public quotation in December 1968 at a valuation of $17.7 million

(2) P/E of 283 on severely reduced earnings before extraordinary items. Current market valuation is still approximately $15 million, suggesting little movement in the 37% non-directors and non-family holdings. In spite of reduced earnings 1969 dividend was marginally increased over 1968.

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USA - MANUFACTURERS OF INDUSTRIAL GASES : SUMMARY OF BASIC INFORMATION

Name of Company Year Compiled	City/ State all locations	President (and No. of related directors	Total No. of directors	No. Empl.	Total Turnover of which gas sales (%)	Capital Employed. *Authorised *Issued Capital	Post Tax Profit	Officers (No.) Previously with:	Business Activities	Key Points & Additional Financial Information
					$ mill	$ mill	$ mill			
National Welders Supply Co. 1968	Charlotte, NC Branches in North and South Carolina. Plants at Goldsboro, NC and Columbia, SC	J.A.Turner Jrn. (3)	8	226	5.3 47%	1.9*	0.13	Airco (1)	Makes and distributes industrial and medical gases. Wholesales welding and medical supplies	Holds 33% of shares in Marox Inc. Average growth rate in sales since 1959 is 12% pa. Return on capital employed 11% Return on sales 2% Sales to capital employed 4.4 Current assets/current liabilities 2.1
Kansas Refined Helium 1968	Wichita, Kans. Otis, Kans.	G.A.Angle (sole owner)	-	150	5 50%	42.4	na	-	Helium, natural gas, liquid nitrogen, isobutane and gasoline (60%). Oil and gas production (20%). Oil and gas oil drilling (20%). Oil and gas runs are sold to major oil and pipeline companies	Figures apply to group of 9 companies involved in helium production, oil and gas drilling and production. 100,000 cu ft helium produced annually. Current assets/current liabilities 2.5 Sales/capital employed 0.1% (very low due to large oil, gas and helium reserves if these are excluded the ratio is 0.7)
Dolex 1968	Chattanooga, Tenn. Tennessee, North and South Carolina, Georgia.	R.J. White (2)	9	115	4.9	3.6	0.01	-	Makes compressed and liquified industrial and medical gases and wholesales welding supplies. In 1960 began manufacturing argon.	Between 1965 and 1967 Big Three hold 50% of the shares in this company. In 1967 net loss was $177,000 Current assets/current liabilities 1.1 Return on capital employed 0.6% Return on sales 0.3% Sales/capital employed 1.4
Alabama Oxygen 1967	Birmingham, Ala. Alabama area	H.L.Kimerling (3)	5	100	2.9	4.8	0.25	-	Makes oxygen, nitrogen and acetylene (70%). Wholesales welding supplies and hardware utilised with compressed gases	Associated with H.Kimerling & Sons, wholesalers of scrap metal and welding equipment Current assets/current liabilities 2.3 Return on capital employed 12.5% Return on sales 8.5% Sales/capital employed 1.5

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Name of Company	Date of entry and addresses	President (and No. of related directors)	Total No. of directors	No. Empl.	Total Turnover of which gas sales (%)	Capital Employed. *Authorised *Issued Capital	Post Tax Profit	Officers (No.) Previously with:	Business Activities	Key Points & Additional Financial Information
					$ mill	$ mill	$ mill			
Whitmore Oxygen Co. 1944	Salt Lake City, Utah Branches in Provo, Utah, and Ogden, Utah	R.Whitmore (0)	2	80	1.5 50%	*0.09	na	-	Makes and sells welding gases and wholesales welding supplies and equipment	Control held by the Whitmore family since 1944.
Superior Air Products 1948	Newark, NJ	Mrs F.H.Peff (1)	4	75	2 5%	+0.2	na	-	95% of sales are from the manufacture of storage equipment	Control held by the Peff family
Pacific Oxygen Co. 1956	Oakland, Calif.	J.Josephian (2)	3	65	1.5 100%	+0.5	na	-	Makes and sells oxygen, argon, nitrogen and acetylene	Trade name POXCO. Associate of Industrial Welding Supply
Indiana Oxygen 1943	Indianapolis, Ind. Oxygen plant at Indianapolis, acetylene plant at Green Grove, Indiana	J.M.Grant (2)	3	50	1 90%	+0.07	na	-	Makes and distributes oxygen, acetylene and nitrogen to hospitals industry and welding concerns. Also makes automatic cutting machines	
Welders Supply Co. 1950	Little Rock, Arkansas, Memphis area	R.G.Harrison (3)	4	45	1.3 35%	0.5	0.04	-	Makes welding gases (35%) and wholesales welding supplies (65%)	Current assets/current liabilities 1.7 Return on sales 3% Return on capital employed 7% Sales/capital employed 2.5
Acetylene Oxy Co. Inc.	St. Louis, Mo	I.Fausek,Jr. (2)	6	40	1.5 100%	+0.025	na	-	Makes and sells O_2, N_2, H_2, CO_2, acetylene, argon, helium, propane and oxygen	This is one of several large companies owned by similar interests (not specified)
Thermice Corp. 1958	Philadelphia, Pa Branches in Chicago, St. Louis, Newark, NJ Cleveland and Cincinnati, Ohio. Baltimore, Md. Boston	S.S.Neuman (0)	0	40	5 100%	-2.8	loss	-	Makes and sells carbon dioxide gas in cylinder and dry ice form, utilising parent company's by-products. Since 1960 distributes CO_2 in liquid form	A subsidiary of Publicker Industries. 99% of debt due to inter-company loans and advances
Carbide Reduction 1955	Linden, NJ Branch in Brooklyn, NY	J.V.Evans, Jr. (1)	2	53	+na 100%	+0.002	na	-	Makes oxygen, acetylene and nitrogen gases with sales to over 4,000 jobbers and industrial accounts in NJ and NY	Affiliated to Evans Air Products. All State Gases & Cold Ship Corp. Certain debts secured by Union Carbide

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Name of Company Year Founded	City/ State All Locations	President (and No. of related directors)	Total No. of directors	No. Empl.	Total Turnover of which gas sales (%)	Capital Employed. *Authorised *Issued Capital	Post Tax Profit	Officers (No.) Previously with:	Business Activities	Key Points & Additional Financial Information
					$ mill	$ mill	$ mill			
Merritt-Holland Welding Supply 1933	Ilcington, NC	D.T.Merritt (1)	4	5+	1.2 30%	0.001	na	-	Makes oxygen and acetylene (30%) Wholesales (45%) and retails (10%) welding equipment, wholesales refrigeration and heating equipment (10%)	
Kansas Oxygen 1947	Hutchinson, Kans. Kansas area	G.E. Kains (0)	7	28	0.9 50%	0.7	0.1	-	Makes oxygen and acetylene (50%) wholesales welding equipment and supplies (50%)	Current assets/current liabilities 2.9 Return on sales 15% Return on capital employed 16% Sales/capital employed 1.1
Linde Air Products 1922	Tonawanda/Buffalo NY	J.T.Evans, Jr. (1)	5	25	0.25 100%	+0.15	na	-	Makes and distributes oxygen to industrial plants and hospitals in the NY Metropolitan area	Affiliated to Carbide Reduction, All State Gases, Weld Ship Corp. (electric and acetylene welders)
Gulf Oxygen 1930	Lake Charles LA	E.M.Hines (3)	7	23	na	0.89	na	-	Makes acetylene, hydrogen and oxygen	President owns 100% of shares Current assets/current liabilities 0.9
Detroit Blake & Gas 1916	Detroit, Mich	C.M.White (0)	3	17	0.4	0.16	na	-	Makes acetylene, oxygen and gas equipment	Current assets/current liabilities 1.0 Sales/capital employed 2.6 Accumulated deficit $24,000
Marox 1967	Hopwell, VA	C.D.L.Perkins (0)	6	14	na	na	na	Airco (1) Durdett (1)	Makes nitrogen gas which is sold to Allied Chemical Corp. and nitrogen, oxygen and argon in liquid form which is sold to the joint owners	Company formed in 1967 by Durdett, Process Plant Corp. and National Welders Supply. No financial details are available.
Welders Supply 1940	Cleveland, Ohio	A.P.Horvath (1)	3	14	0.6 50%	0.1	na	-	Makes and sells oxygen and acetylene and wholesales welding supplies	
Tyler 1959	Inglewood, Calif. South California	J.A.Tyminski (1)	3	12	0.2	0.08	0.02	-	Makes and distributes carbon dioxide	
All State Gases 1964	Travis, NY Branch in Slatersville, RI	J.T.Evans, Jr. (0)	1	10	na 100%	+0.1	na	-	Makes and sells acetylene to jobbers and industrial concerns in Rhode Island and Massachusetts	Affiliated to Evans Air Products Carbide Reduction & Weld Ship Corp.
Energy Gases Inc. 1969	E.Syracuse, NY Syracuse area	J.C.Javeli, (1)	3	9	0.3	na	na	-	Makes industrial gases, acetylene and acetylene tanks	

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Section 11(4)

Table 33(cont)

Name of Company and Parent	City/ State of all locations	President (and No. of related directors)	Total No. of directors	No. Empl.	Total Turnover of which gas sales (%)	Capital employed. authorised *Issued Capital	Post Tax Profit	Officers (No.) Previously with:	Principal gas activities	Key Points & Additional Financial Information
					£ mill	£ mill	£ mill			
East Texas Oxygen Co. 1956	Tyler, Texas	E.T. West (3)	4	9	0.24	0.54	na	NCG (1)	Makes and sells oxygen, nitrogen and acetylene and compressed air	Current assets/current liabilities 0.9 Sales/capital employed 0.5 Retained earnings dropped 1967/1968 by £120,000
W.M.Curtis Co. 1959	Hollywood, Calif.	M.Christner (6)	1	6	na 100%	+0.001	na	NCG(1)	Makes technical, therapeutic and industrial gases	70% of sales to the aircraft industry, 25% to hospitals, Christner also owns Physicians Oxygen Gas Service (wholesaler)
Cryogenic Rare Gas Laboratories 1964	Newark, NJ	E.Dietz, Jr. (0)	3	0	0.4	+0.005	na	-	Makes xenon, krypton and neon for the electronic and lamp industries and for nuclear research	Closely associated with U.S.I. Co., manufacturers of neon electrodes
Pipe Oxygen	Pinge Junction, Ohio	D.C.Duvall (President of parent)	na	na	na	na	na	-	Makes oxygen for use by parent in the production of steel	A subsidiary of Sheeling-Pittsburgh Steel Corp.
Amarillo Oxygen Co.	Amarillo, Texas	J.C.Trewel (sole owner)	-	na	0.2	na	na	-	Makes acetylene, oxygen and nitrogen	
Hertzum Oxygen	Silvatree, [illegible]	P.Meckel (2)	3	na	na	0.09	na	-	Makes commercial and medical oxygen	Inter-company relations are confined to merchandise advances and short term loans.
Hawkeye Oxygen	Whitevac, Ia.	P.Meckel (2)	3	na	na	0.11	na	-	Makes oxygen	
Whitevac Plate	Whitevac, Ia.	P.Meckel (2)	3	na	na	0.17	na	-	Makes acetylene	

Source: Dun & Bradstreet reports, retained at Hammersmith House.

Comments

(1) Based on 1967 or 1968 information

(2) This represents only a very short extract, in each case, from the information available on the source

(3) There are American companies known to be active as manufacturers of industrial gases

The order of listing is according to number employed

The Predicast report on the USA Cryogenic Gas Industry (No.44), July 1967, states that there are 100 companies producing industrial gases in the USA.

It is reasonable to assume that this number has since decreased to approximately [illegible] to mergers and acquisitions.

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USA - DISTRIBUTORS OF INDUSTRIAL GASES: SUMMARY OF BASIC INFORMATION

Name of Company [illegible]	Location & distribution area	President (and No. of related directors)	Total No. of directors	No. Empl.	Total Turnover of which gas sales (%) $ million	Capital Employed, + Authorized * Issued Capital $ million	Post Tax Profit $ million	Officers (No.) Previously with:	Authorised Agents for:	Activities	Key Points & Additional Financial Information
[illegible]	Torrance, Calif. Santa Ana, El Monte, Los Angeles & Pasadena, Calif.	na	na	100	5	+ 1.8	0.2	-	-	Wholesale gas and electric welding supplies, oxygen & acetylene	Company under reorganization therefore directors names not revealed.
[illegible]	Los Angeles, Calif. Los Angeles area	J. Pressman (0)	3	97	na	* 0.04	na	-	-	Wholesales CO_2 & fire extinguisher chemicals	Affiliated to 7 companies with similar activities.
[illegible]	Columbus, Ohio	J.R. Smith (2)	6	50	1.4	0.8	0.06	-	-	Makes & sells compressed gases & wholesales welding supplies	Current assets/ current liabilities 1.2 Return on sales 4% Return on capital emp. 15% Sales/ capital emp. 8.3
[illegible]	Denver, Colo.	R.D. Lofgren, Jr (0)	6	47	3	0.9	na	-	LCC	Wholesales & retails welding supplies Inhalation therapy div. serves doctors & hospitals. Helium supplied	Current assets/ current liabilities 1.8 Return on sales 3% Return on capital emp. 13% Sales/ capital emp. 4.0
[illegible]	Los Angeles, Calif. California area	R. Bogard (0)	3	45	2.5	0.43	na	LOC (1)	LCC	Wholesales welding equipment & supplies	Total net assets £-30,000 Current assets/ current liabilities 2.4 Sales/total net assets 5.2
[illegible]	Rahway, NJ	G.F. Sulfrian (1)	2	43	0.9	+ 0.1	-	Superior Air Products (1)	-	Makes gas containers (50%) Research helium equipment (25%) Makes & distributes liquefied gases (25%)	

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1564.- DISTRIBUTORS OF INDUSTRIAL GASES: SUMMARY OF BASIC INFORMATION (cont)

Name of Company and Details	Location & distribution area	President (and No. of related directors)	Total No. of directors	No. Empl.	Total Turnover of which gas sales (%) $ million	Capital Emp. + Authorised * Issued Capital $ million	Post Tax Profit $ million	Officers (No.) Previously with:	Authorised Agents for:	Activities	Key Points & Additional Financial Information
Tulsa Oil Industrial Products Inc	Kansas City, MO	J.B. Francis (1)	3	40	1.5	0.3	na	Puritan-Bennett (3)	Hobart Victor Equipment Jackson Products	Wholesales & retails welding equipment and gases	Formerly a division, now a subsidiary of Puritan-Bennett. Current assets/current liabilities 2.4 Sales/capital employed 2.5
Technical Gas Products Inc	Linden, NJ	M. Guillaume (1)	4	31	na	na	na	UCC (2)	-	Makes & sells compressed gas mixtures (90%) and gas handling apparatus (10%)	
Jesse Duff Inc	Los Angeles, Calif. Glendale & Northbridge, Calif.	J.G. Duff, Jr (1)	5	30	1.3	+ 0.02	na	-	-	Wholesales welding gases & equipment	Current assets/current liabilities 2.4 Return on sales 1.8% Return on capital employed 6.6% Sales/capital employed 3.3
Welding & Cutting Inc	Cleveland, Ohio North-eastern, Ohio	M.M. Powar (4)	5	28	1 50%	0.25	0.02	-	-	Sells O_2, argon and acetylene. Welding equipment (30% of sales) Ice cream and meat truck equipment (26%)	Associated with W Lit Cut and Air Products Distributing Co (no apparent link with AP & G). Current assets/current liabilities 2.7 Return on capital employed 5.9% Return on sales 1.8% Sales/capital employed 3.4
Welding Gas & Equipment Inc	Detroit, Mich. Metropolitan Detroit	C.B. Brown (1)	4	26	1.3	0.33	0.02	LCC (2)	- LCC	Wholesales oxygen, acetylene & welding supplies	Current assets/current liabilities 2.7 Return on sales 1% Return on capital employed 5% Sales/capital employed 3.0

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USA - DISTRIBUTORS OF INDUSTRIAL GASES: SUMMARY OF BASIC INFORMATION (cont)

Name of Company Year Founded	Location & distribution area	President (and No. of related directors)	Total No. of directors	No. Empl.	Total Turnover of which gas sales (%) $ million	Capital Exp. + Authorised + Issued Capital $ million	Post Tax Profit $ million	Officers (No.) Previously with:	Authorised Agents for:	Activities	Key Points & Additional Financial Information
[illegible] 1941	Bay City, Mich.	R. Jaffe (3)	4	26	1.2	0.66	na	-	-	Wholesales & retails welding supplies, gases, chemicals & plastic swimming pools	Current assets/ current liabilities 2? Return on sales 17% Return on capital employed 31% Sales/ capital employed 1.8
[illegible] 1911	Kansas City, MO (Greater Kansas City area and Springfield, MO	B.J. Beaver (0)	4	25	0.9	0.25	0.15	LCC (1) MCG (3)	MCG Co	Wholesales welding supplies & oxygen	Current assets/ current liabilities 1.2 Return on capital employed 60% Return on sales 17% Sales/capital employed 3.6
[illegible] 1945	Kansas City, MO & Missouri & E. Kansas	J.P. Kirk (1)	4	21	2	+0.03	na	Airco (1)	AP & C	Wholesales (90%) and retails (10%) range of welding & cutting supplies & CO_2	Associated with Kirwick Fastener Supply Inc.
[illegible] & Supply Co 1950	Milwaukee, Wis. Milwaukee area	P. Hockel (2)	3	25	1.5	0.70	0.02	-	-	Jobbers of industrial compressed gases	Current assets/ current liabilities 1.1 Return on sales 1.5% Return on capital employed 4.2% Sales/capital employed 2.6
[illegible] 1952	Detroit, Mich.	M. Wender (1)	3	22	na	0.03	na	-	-	Deals mainly in used machinery. Also distributes oxygen	

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USA - DISTRIBUTORS OF INDUSTRIAL GASES: SUMMARY OF BASIC INFORMATION (cont)

Name of Company & Address	Location & distribution area	President (and No. of related directors)	Total No. of directors	No. Empl.	Total Turnover of which gas sales (%) $ million	Capital Exp. + Authorised * Issued Capital $ million	Post Tax Profit $ million	Officers (No.) Previously with:	Authorised Agents for:	Activities	Key Points & Additional Financial Information
[illegible] 1[illegible]	Saginaw, Mich Saginaw area	H. Macaulay, Jr (1)	4	23	0.5	0.52	na	NCG (1)	-	Wholesales liquid oxygen, nitrogen, argon, acetylene, medical gases, carbon dioxide, helium	Current assets/ current liabilities 2.5 Sales/capital employed 1.1
[illegible] Air [illegible]	Los Angeles, Calif. Southern Calif.	E.J. Gilmore (C)	3	15	1	+ 0.03	na	-	-	Wholesales oxygen, nitrogen, argon	
[illegible] 1[illegible]	Morristown, PA 50 mile radius Morristown	E.R. Joseph (2)	4	15	na	* 0.025	na	Burdett (1)	-	Wholesales welding gases & welding supplies	Associated with Erie Supply Co & Morey Flux & Chemical Co. Both distribute welding supplies
[illegible] 1[illegible]	Waltham, Mass Brooklyn, NY	M. Andonian (1)	3	15	na	na	na	-	-	Makes liquid gases, gas storage dewars and cryogenic systems for research and industry	A subsidiary of Andonian Ass. Holds 80% shares in Cryogenic Fabricators Inc.
[illegible] 1[illegible]	Amarillo, Texas	J.L. Prowell (2)	4	15	0.7	0.34	na	-	-	Wholesales welding gases and supplies	Current assets/ current liabilities 4.5 Sales/capital employed 2.1
[illegible] Products [illegible] 1[illegible]	Kansas City, MO	J.R. Michael (1)	3	15	1	* 0.02	na	Airco (1)	Airco	Wholesales oxygen tanks, acetylene & welding supplies	Certain debts secured by Airco

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USA - DISTRIBUTORS OF INDUSTRIAL GASES: SUMMARY OF BASIC INFORMATION (cont)

Section 11 (c)
Table 34(cont).

Name of Company & Its Group	Location & distribution area	President (and No. of related directors)	Total No. of directors	No. Empl.	Total Turnover of which gas sales (%)	Capital Emp. + Authorised * Issued Capital	Post Tax Profit	Officers (No.) Previously with:	Authorised Agents for:	Activities	Key Points & Additional Financial Information
					$ million	$ million	$ million				
Industrial Welding [illegible]	Compton, Calif. Los Angeles county area	R.E. Joseph (1)	4	13	0.4	0.15	na	-	Pacific Oxygen	Distributes welding supplies, hydrogen & helium	A subsidiary of Pacific Oxygen. Current assets/ current liabilities 1.0 Sales/total net assets 2.6
[illegible] 1967	Sedalia, MO Macon & Springfield, MO	O.C. Smith (1)	3	13	0.7	0.17	na	-	-	Wholesales welding supplies & gases, therapy oxygen & medical gases	Current assets/ current liabilities 5.8 Sales/capital employed 3.3
[illegible] Supply Co	Portland, Ore.	G. Schnitzer (3)	7	13	0.95	na	na	-	-	Wholesales & retails welding gases & welding supplies	A subsidiary of Industrial Air Products (part of L'Air Liquide group)
[illegible] Co Inc [illegible]	Buffalo, NY	A. Jacobowitz (0)	4	12	na	na	na	-	-	Sales agent for parent, dealing in industrial gases & equipment for the chemical & food industries	A subsidiary of Arnold Equipment Corp. manufacturer of special industrial gas plants & equipment. Has contract with Bureau of Ships worth $1.5 million annually
[illegible] [illegible]	Detroit, Mich. Detroit area	H. Stonebeck	3	12	0.75	0.34	na	-	LCC	Wholesales & retails acetylene & welding equipment	Current assets/ current liabilities 2.2 Sales/capital employed 2.1
[illegible] Carbonic Co	Detroit, Mich. Michigan area	F.R. Morrison (0)	1	12	0.28	na	na	LCC (1)	-	Wholesales carbon dioxide (80%) and manufacturing representative for ice cream cabinets	

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CX-44-Z-51

USA - DISTRIBUTORS OF INDUSTRIAL GASES: SUMMARY OF BASIC INFORMATION (cont)

Name of Company	Location & distribution area	President (and No. of related directors)	Total No. of directors	No. Empl.	Total Turnover of which gas sales (%) $ million	Capital Emp. * Authorised * Issued Capital $ million	Post Tax Profit $ million	Officers (No.) Previously with:	Authorised Agents for:	Activities	Key Points & Additional Financial Information
[illegible]	Detroit, Mich.	R. Sprague (2)	3	12	0.65	0.13	na	-	-	Wholesales oxygen & acetylene (75%) and welding equipment	Total net assets £127,000 1966 current assets/ current liabilities 1.3
[illegible]	Santa Fe Springs, Calif. Los Angeles area	D. Clapp (1)	3	12	0.4		na	Airco (1)	-	Wholesales dry ice & CO_2 (90%) Industrial gases (10%)	
[illegible]	Los Angeles, Calif.	Partners: M. Mahoney J.J. Donahue F.P. Stockman	-	11	0.35 40%	0.08	0.06	Stuart Oxygen (3)	-	Wholesales welding equipment (55%) and gases (40%). Retails welding equipment (5%)	Total net assets £77,000 Current assets/ current liabilities 2.2 Return on sales 18% Return on total net assets 83% Sales/total net assets 4.5
[illegible]	Louisville, Ky	W.A. Nivelaz (2)	4	10	0.5	0.69	na	-	-	Distributes industrial and chemical gases. Brand name 'Inoxo'. Makes small acetylene cutting machines & emergency oxygen machines	Subsidiary of Industrial Equipment Co. Inc. Current assets/current liabilities 4.3 Sales/capital employed 0.8
[illegible]	Denver, Colo.	N.J. Diehl (1)	3	9	0.5 30%	na	na	-	-	Wholesales carbon dioxide (30%), dog food (30%), maintains cold storage facilities (40%)	Under the same ownership as Denver Carbonic (q.v.)

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USA - DISTRIBUTORS OF INDUSTRIAL GASES: SUMMARY OF BASIC INFORMATION (cont)

	Location & distribution area	President (and No. of related directors)	Total No. of directors	No. Empl.	Total Turnover of which gas sales (%)	Capital Emp. • Authorised • Issued (capital)	Net Inc Profit	Officers (No.) Previously with:	Authorised Agents for:	Activities	Key facts, financial information & ratios
					$ million	$ million	$ million				
	Shreveport, La	J. Wand (1)	3	9	0.5	0.15	0.02	Airco (1)	-	Wholesales oxygen	Affiliated to Lord Carbon Co. Current assets/ current liabilities 1.7 Return on sales 3.1% Return on capital employed 11.1% Sales/capital employed 3.1
[illegible] Welding Co	Denver, Colo. Metropolitan Denver area	B.G. Harrington	4	8	0.7	0.23	0.01	Airco (3)	Airco	Wholesales (70%) and retails (30%) welding equipment & carbon dioxide	All debts secured by Assets. Current assets/ current liabilities 1.2 Return on sales 1.4 Return on capital employed 4.4% Sales/capital employed 2.4
[illegible] Welding Equipment	Downey, Calif. S.California	C.G. Johnson (sole owner)	-	8	0.5	na	na	-	-	Sells oxygen & welding supplies	
[illegible] Welding Supply Co	Kansas City, MO Missouri & Kansas	T.T. Johnson (3)	4	8	0.9	+ 0.01	0.03	-	LCC	Wholesales welding equipment, oxygen, CO_2, acetylene & welds	Distributes to jobbers and direct to commercial users
[illegible] Oxygen & Acetylene Co	Detroit, Mich Detroit area	Mrs F. Robinson	3	7	0.3	0.08	na	-	-	Distributes oxygen, hydrogen & acetylene	Current assets/ current liabilities 1.5 Sales/capital employed 3.9
[illegible] Carbonic Ltd	Denver, Colo. Kansas, Mexico, Wyoming, Nebraska	C.F. Tremblom (2)	3	7	0.18	0.08	na	-	-	Wholesales dry ice & liquid carbon dioxide	Current assets/ current liabilities 19 Sales/capital employed 2.3

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USA - DISTRIBUTORS OF INDUSTRIAL GASES: SUMMARY OF BASIC INFORMATION (cont)

Name of Company & Principal Activities	Location & Distribution Area	President (and No. of related directors)	Total No. of directors	No. Dirs.	Total Turnover of which gas sales ($) $ million	Capital Emp. * Authorized * Issued Capital $ million	Post Tax Profit $ million	Offices (No.) Previously with:	Authorized Agents for:	Activities	Key Points & Additional Financial Information
[illegible]	Stanton, Calif.	C.H. Ferry (1)	2	6	0.2	+ 0.01	na	LCC (1)	-	Wholesales industrial gases & welding equipment	
[illegible]	El Monte, Calif. Los Angeles area	O.A. Eichman (0)	3	4	0.3	+ 0.03	na	NCG (1)	-	Retails welding equipment & oxygen	
[illegible]	Cleveland, Ohio	J.J. Check (1)	3	3	0.1	na	na	Burdett (1)	-	Wholesales (80%) and retails (20%) welding supplies and welding gases	Ohmo Welding Gases Co.
[illegible]	Detroit, Mich.	J.S. Ulmer (sole owner)	-	3	0.1	na	na	-	-	Wholesales oxygen, welding equipment and auto supplies	
[illegible]	Cleveland, Ohio State of Ohio	C.R. Munn (0)	2	3	0.1	na	na	-	NCG	Nitrogen & helium condensed at absolute zero to 100^{0}F	Serves the refrigeration, medical and food industries. Associated with Cleveland Freight Lines Inc.
[illegible]	Cleveland, Ohio	J.M. Davis (1)	2	3	0.15	na	na	-	Airco	Wholesales welding equipment & gases (70%), service welding equipment (30%)	Trading name is Airco Davis Welding Supply. Certain debts are secured by Airco
[illegible]	Denver, Colo.	M.J. Diehl (sole owner)	-	3	0.2	na	na	-	- -	Wholesales dry ice (85%) and CO_2 (15%)	Under the same ownership as Crews Storage & Carbonic Co (q.v.)

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USA - DISTRIBUTORS OF INDUSTRIAL GASES: SUMMARY OF BASIC INFORMATION (cont)

Section 11 (c)
Table 34(cont.)

Name of Company [illegible]	Location & distribution area	President (and No. of related directors)	Total No. of directors	No. Exec.	Total Turnover of which gas sales ($) $ million	Capital Emp. + Authorised * Issued Capital $ million	Post Tax Profit $ million	Officers (No.) Previously with:	Authorised Agents for:	Activities	Key Points & Additional Financial Information
[illegible]	Fullerton, Calif. Los Angeles	W.B. Johansing (O)	3	3	na	+ 0.15	na	-	-	Wholesales liquid carbon dioxide & acetylene to industrial and agricultural accounts	Associated with Cordix Co. a manufacturer of carbon dioxide
[illegible]	Ann Park, Mich.	A.J. Koner (O)	1	3	0.12	na	na	-	-	Distributes carbon dioxide and carbonators	
[illegible]	Detroit, Mich.	N. Rahain (O)	1	1	na	na	na	-	-	Distributor of pure carbon dioxide	Sells 5,000 tons gas annually
[illegible]	Liberty, MO	H.L. Doggess (1)	3	1	0.1	+ 0.03	na	-	-	Retails welding supplies & oxygen	

Notes:

1. Based on 1967 or 1968 information.
2. This represents only a very short extract, in each case, from the information available in the source.
3. These are American companies which appear in the American Yellow Pages and are known to be active as industrial gas distributors in the following seven cities: Denver, Colorado; Portland, Oregon; Los Angeles, California; Detroit, Michigan; Cleveland, Ohio; Kansas City, Missouri; Greater New Orleans.
4. The order of listing is according to number employed.

Source: Dun & Bradstreet Reports - retained in Hammersmith House.

CI-44-2-56

SECTION 11(d)

COMPANY ACQUISITIONS 1945 - 1969

Union Carbide (Linde Division) and Airco consolidated their positions by the acquisition of small industrial gas companies prior to 1946. There were also a number of acquisitions made by Chemetron and Big Three during the 1950's and early 1960's.

Presumably for anti-trust reasons, there have been few acquisitions over the last 5 years with the exception of Liquide's recent acquisition of 3 companies to give their entry into the US market.

There have been acquisitions by the major industrial gas companies in recent years, but these have been part of planned diversifications mainly away from gases.

There is little published information on motivation for many of the earlier acquisitions but the general picture appears to be as follows :-

a The opportunity to penetrate new geographical areas or consolidate overall.

b The opportunity to increase sales, eg, when Air Products & Chemicals acquired Southern Oxygen Co. in 1961 AP's sales were $48.5 million and those of Southern Oxygen $12.0 million.

c The availability of additional distribution facilities.

d The attractiveness of the price of the company at the time.

There have been few cases of spin-off or disposal. The two major cases have been the sale of Liquid Carbonic Corp. by General Dynamics Corp. to Houston Natural Gas Co, in 1969 as a result of a 1966 Federal Court Order made under anti-trust legislatic and the 1969 sale of American Cryogenics by Standard Oil Co. (New Jersey) to L'Air Liquide; Standard Oil having acquired it in 1964 from the management.

There have also been several larger discussions eg. Air Products and Southern Nitrogen Co.Inc. in 1961, Big Three and Victor Equipment in 1965, but nothing materialized. There have also been several approaches from outside companies to Chemetron and there is at present a contested bid for this company by Sun Chemical.

The anti-trust legislation is being studied at the present and it is hoped that a working paper will be available, covering the Liquid Carbonic disposal. In the meantime a relevant article on "Anti-Trust" from the Financial Times dated 7 October, 1969 is attached as Appendix J.

CX-44-2-57

A 4093

SECTION 11 (e)

USA INDUSTRIAL GAS COMPANIES

RESEARCH & DEVELOPMENT

The two pages that follow have been received from Dr J.B. Gardner, Norden.

We have also received from him a survey dated October 1967, on Union Carbide's R & D effort, assessing its impact on BOC Group activities. This is available as working paper No. 19

CX-44-Z-5F

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Section 11(c)

USA INDUSTRIAL GAS COMPANIES

RESEARCH & DEVELOPMENT

1 Level of Expenditure

As far as published information goes the following figures are available -

AP	1968 & 1969 -	$5 million, approx:
Air Reduction	1968 -	$15 million "
Union Carbide Corporation -	1969 -	$30 million "

(The latter is for the total Corporation)

Estimate made two years ago of expenditure by UC from a detailed look at their R & D effort was about $16 million.

Expressed on percentage of turnover, figures are -

AP - 3.5% - 1968

Air Reduction - 3% - 1968

Linde Division of UC - 4.3% (Estimate)

BOC - approximately 2%

Bearing in mind, however, that the cost of R & D in America is significantly higher than in the UK - cost per graduate is now probably $40 - 50,000 (£17 - 21,000), as against UK figures of the order of £8 - 12,000 per graduate, BOC's R & D effort may be more comparable than at first appears. Too much emphasis should however not be given to above figures unless one knows what is included in "R & D"; the figures can be misleading.

2 Activities

Union Carbide In the industrial gas business UC were the leading company in innovation through R & D; they may still be though information on this has been lacking during the last year or two. They pioneered, for example, -

i Powder vacuum insulation and the development of VIE tanker pump systems for filling VIEs, and hence the modern concept of an LO distribution system.

ii Superinsulation and its application in particular into the very low temperature field.

iii The GLIP plants, or as called by UC "Z" plants.

iv Advance distillation tray design and concepts.

v Polarstream and use of LN in transit.

vi Molecular sieves, development and prediction.

There may be other areas but the above indicates those where they have been strong.

It should be pointed out, of course, that their R & D effort stretches back well before the last war, and it

- 11 -

was already very active in 1945. In the very low temperature field, UC have latterly played a relatively quiet part but they appear to be concentrating their efforts on superconducting cables for the 1980s, supported by a contract from the American utilities.

AP We have no detailed information on their R & D station and their activity. As far as I know, no BOC man has had a good tour of their establishment. A number of their R & D personnel are known personally to some of us and they are certainly good. The impression I get is that AP has a high quality R & D effort which is reinforced, at least in the past years, by a number of Government contracts which have given them know-how for exploitation in the commercial field.

Air Reduction Spending in R & D has been significantly reduced recently. It is interesting to note however, that spending on the industrial gas related R & D did not appear to me to be very high in Air Reduction until possibly the last decade, or less. Partly due possibly to lack of relevant plant production facilities and need to reinforce this with some R & D. They probably spend more effort in gas applications, such as in the food side than in the direct activities connected with the industrial gas business. Some evidence of this is the fact that Air Reduction are one of the late comers into the field of distribution of oxygen as liquid. They were running high pressure trailers round when Linde (UC) already had a liquid system in operation. My impression is that in the industrial gas field, Airco's R & D effort has not been particularly successful.

Section 12

THE RELATIONSHIP OF WELDING EQUIPMENT AND THE INDUSTRIAL GASES BUSINESS

CX-44-2-60

A 4097

SECTION 12

THE RELATIONSHIP OF WELDING EQUIPMENT AND THE INDUSTRIAL GASES BUSINESS

The industrial gas industry and the welding equipment industry have traditionally been closely interlinked.

Of the seven major gas manufacturing firms in the USA six are also active in the welding equipment area.

The welding equipment business however, is much more fragmented than the gases business; there are well over 200 manufacturers of various types of welding equipment, reflecting the wide variety of products involved (power sources, electrodes, accessories, safety equipment etc). The seven major gas firms account for about $250 million worth of welding equipment sales - or some 50 to 55% of total equipment turnover.

The size and growth of the welding equipment market, along with the gases used for welding is shown below:-

	£ million 1956	£ million 1969	Average growth rate % pa
Arc welding equipment			
Machines	54.6	123.4	7.0
Electrodes	144.1	219.8	3.6
Accessories	23.0	28.6	1.8
Sub-total	221.7	371.8	4.4
Gas welding equipment			
Apparatus	42.0	75.8	5.0
Rods	16.2	20.0	1.8
Accessories	7.2	8.4	1.7
Sub-total	65.4	104.2	3.9
Total welding equipment and consumables (1)	287.1	476.0	4.4
Gases used for welding			
Acetylene	71.6	184.3	8.2
Oxygen	87.5	140.9	4.1
Argon & Helium	29.3	83.2	9.1
Gases Sub-total	188.4	408.4	6.7
Total all welding equipment, consumables & gases	475.5	884.4	5.3
Welding equipment and consumables as % total	60.5	53.8	-

Source: The Welding Distributor, July/August 1969.

(1) Excluding resistance welding

It is important to note that the figures used here for gases do not agree with those in the gases sections. The difference presumably reflects retail final sales values of gases as against ex factory prices, in many cases the figures seem too high; the interpretation of these differences is still in hand.

We have no comprehensive information on the overall marketing pattern of gases and equipment and the relationship of gas and welding equipment distributors to manufacturing companies. The following facts are relevant in this context.

1 There were some 3,000 distributors of welding products with retail sales of equipment of $582 million (including resistance welding equipment) in 1967 - giving an average sale of $110,000 per distributor.

One distributor - not identified, is said to have exceeded $10 million; many have sales below $50,000.

2 Welding distributors handle 92% of welding accounts and some 73% of total welding equipment sales (again including resistance welding)

3 Welding distributors sell some $200 million worth of welding gases.

4 Welding distributorship is a fiercely competitive business, especially in the areas of high industrial concentration. In the Chicago area, for example, there were 119 welding supply distributors, competing for an estimated $65 million worth of equipment and gases business.

5 Air Reduction in 1967 sold some $40 million of its welding equipment through distributors (about 60%) of its total sales in this category.

Airco sells some $30 million worth of their gases via distributors which, in 1967 accounted for some 80% of their cylinder sales. It is their intention ultimately to transfer all cylinder business to distributors.

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A 4099

SECTION 13

MEDICAL GASES

a Nitrous Oxide

b Medical Oxygen

CX:44-2-63

A 4100

Section 13(a)
Table 35

NITROUS OXIDE PRODUCTION

Year	USA			UK
	Mill.galls	Mill.lb.	Mill.$	Mill.galls.
1960	561	9.3	5.4	177
1961	621	10.3	5.7	183
1962	698	11.5	6.0	187
1963	781	12.9	4.8	194
1964	779	12.9	4.5	200
1965	865	14.2	4.1	206
1966	911	15.6	4.5	212

PRODUCTION FORECASTS, BASED ON 1966 OUTPUT

1966	911[1]	15.6	212[2]
1967	984	16.8	218
1968	1,061	18.2	225
1969	1,147	19.7	232
1970	1,238	21.3	239
1971	1,339	22.9	246
1972	1,446	24.8	253
1973	1,563	26.8	261
1974	1,689	29.0	269
1975	1,826	31.3	277

Note: (1) USA forecast based on 8% rate of growth predicted by SRI

(2) UK forecast based on 3% rate of growth

Sources: USA Current industrial reports
SRI Industrial Gases
BOC Gases Division, Brentford.

A 4101

Section 13(a)
Table 36

NITROUS OXIDE

The current uses of N_2O in the USA are in anaesthesia, aerosols and leak detection. Medical use now accounts for some 65% of sales in the USA, compared with 90% in the UK.

End uses of nitrous oxide, USA/UK comparison

End use	1964 USA %	1964 UK %	1970 (est) USA %	1970 (est) UK %	1980 (est) USA %
Anaesthesia	74	99	62	96	60
Aerosols	25	1	28	4	29
Leak detection	1	-	10		11
	100	100	100	100	100

Source: SRI, Chemical Week 6.2.65.

Costs and prices

Cost into storage 1967

USA 18.3d per 100 galls (Puritan)

UK 19.0d per 100 galls (BOC)

USA selling prices cannot be ascertained as each hospital negotiates its own price with the supplier.

A4102

Section 13b
Table 37

MEDICAL OXYGEN

Output of medical oxygen
Tons per day

Year	Medical Oxygen	Total Oxygen	Medical as % of total	Average annual rate of growth of Medical O_2
1957	150	7,680	2.0	
1958	160	7,820		
1959	170	9,770		
1960	185	11,500	1.6	
1961	195	13,265		1960-67
1962	210	17,245		5.81%
1963	220	20,920		
1964	230	25,525		
1965	240	27,595	0.9	
1966	250	31,160		
1967	275	31,845		
1968	290	35,640		
1969	300	38,700		
1970	320	44,320	0.7	1968-75
1971	350	49,400		6.47%
1972	370	53,320		
1973	400	58,400		
1974	420	64,570		
1975	450	70,750	0.6	

Source: CGA report

SECTION 14

MEDICAL GAS COMPANY PROFILES

- Summary and Basic Information

a USA Manufacturers of Medical Gases

b Distributors of Medical Gases

[illegible] MANUFACTURERS OF MEDICAL GASES : BASIC INFORMATION

Name of Company [illegible]	City/ State All Locations	President (and No. of related directors)	Total No. of directors	No. Empl.	Total Turnover of which gas sales (1)	Capital Employed. +Authorised *Issued Capital	Post Tax Profit	Officers (No.) Previously with:	Business Activities	Key Points & Additional Financial Information
					£ mill	£ mill	£ mill			
S.S. White Co. Dental Division	Philadelphia Pa.	C.M.Nybelt (D)	11	156,000	606.5	212.1	13.7	-	Chemicals, pharmaceuticals, processing equipment, dental health operations	A subsidiary of Pennwalt Corp. since 1965. Information refers to the parent company
Chemetron	Chicago, Ill. Branches throughout US, Latin America, UK, Australia, Canada, Netherlands, Belgium, Japan, Mexico.	J.P.Gallagher (C)	13	5,073	237.5	215.3	10.4	-	Industrial and medical gases and related products (51%) chemicals (25%), metal products and process equipment (24%)	Oxygen production is expected to increase 12% annually until 1975. Over the next 10 years the market for medical gases and supplies is expected to expand at an annual rate of 15 - 20%
Puritan-Bennett	Kansas City, Mo	J.B.Francis (1)	5	730	20.7	15.4	3.4	-	Medical products (77%) Aviation oxygen equipment (14%) Welding supplies and commercial gases (9%)	There are 13 subsidiaries. Current assets/current liabilities 4.4 Return on sales 16% Return on capital employed 24% Sales/capital employed 1.5
Ohio Medical Products	Madison, Wis.	W.Lunger (President of Ohio Medical only)	-	450	na	na	na	-	Medical and anaesthetic gases and equipment to administer these gases; cryosurgery equipment, incubators, respirators	A subsidiary of Air Reduction. Separate financial details are not available
Airco-Carbon Co. of Cleveland [illegible]	Cleveland, Ohio	C.M.Loveman (D)	12	390	13.7 70%	23.6	0.27	Airco (1) [illegible] AFDC (1)	Industrial and medical gases (70%), equipment (30%)	Net profit for the year ended 28.2.69. was 41% less than for 1968

Source: Dun & Bradstreet reports, retained at Hammersmith House

Footnote

(1) Based on 1967 or 1968 information

(2) This represents only a very short extract, in each case, from the information available in the source

[illegible] American companies known to be active as manufacturers of [illegible]

[illegible] of listing is according to number employed

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VT-E-67

USA - DISTRIBUTORS OF MEDICAL GASES : QUALITY OF BASIC INFORMATION

Section 14b
Table 39

Name of Company Year formed	Location & distribution area	President (and No. of related directors)	Total No. of directors	No. Empl.	Total Turnover of which gas sales (%) $ mill	Capital Employed. +Authorised *Issued Capital $ mill	Post Tax Profit $ mill	Officers (No.) Previously with:	Authorised agent for:	Activities	Key Points & Additional Financial Information
Acme Ambulance & Auto Livery Co. 1920	Kansas City, Mo Kansas City area	Mrs L.Y.Hughes (2)	4	20	0.3	na	na	-	Puritan-Bennett	Operates ambulance and hearse service and distributes oxygen	
American Gas & Welding Supply 1929	Los Angeles, Calif. California area	J.Hobson. (1)	2	8	0.4	+0.025	na	Airco (1)	-	Sells medical gases (50%) and welding gases and supplies (50%)	
California Medical Equipment 1959	Los Angeles, Calif.	Partners: F.Yeager G.Yeager	-	6	0.2	0.05	0.0%	-	-	Distributes oxygen and rents medical supplies	Current assets/current liabilities 1.3 Return on sales 19% Return on capital employed 31% Sales/capital employed 4.4
Haley Medical Equipment 1958	Northridge, Calif.	R.D.Haley (2)	3	5	0.1	+0.05	na	-	-	Rents and sells medical equipment and oxygen	Associated with Haley Ambulance Co. and Haley Wheel Chair Cab Co.
Medical Gas and Respiratory Equipment 1955	Cleveland, Ohio. Cleveland area	D.Seeley (sole owner)	-	3	0.1	na	na	-	Bird Corp. Ohio Chemical.Hudson Oxygen	Wholesales, retails and rents breathing and orthopedic equipment and oxygen	

Source: Dun & Bradstreet reports, retained at Hammersmith House

Remarks

(1) Based on 1967 or 1968 information

(2) Data represents only a very short extract, in each case, from the information available in the source

(3) All are American companies which appear in the American Yellow Pages and are known to be active as medical gas distributors in the following seven cities: Denver - Colorado, Portland - Oregon, Los Angeles - California, Detroit - Michigan, Cleveland - Ohio, Kansas City - Missouri, Greater New Orleans.

(4) Order of listing is according to number employed

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SECTION 15

RELATIONSHIP OF MEDICAL GASES WITH MEDICAL EQUIPMENT MARKET

Section 15

Table 40

RELATIONSHIP OF MEDICAL GASES WITH MEDICAL EQUIPMENT MARKETS

Total hospitals in 1967 (less psychiatric)	6,237
Total beds	1,037,000
Total anaesthetists	7,500
Nurse anaesthetists	18,000

Source: American Hospital Association Yearbook

Estimate of total anaesthetic machines in use	50,000
Annual sales of all types	2,500

Ohio believe that 20% of all machines in use are over 10 years old.

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SECTION 16

MEDICAL GASES - MARKETING & COMMERCIAL ASPECTS

a Market Shares

b Commercial Factors

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Section 16 (a)

MARKET SHARES

(i) Nitrous Oxide

Three producers account for 90% of N_2O output.

Producer	Market Share
Puritan-Bennett Corporation	45
Ohio (Airco)	36
Liquid Carbonic (General Dynamics)	9
S.S. White Dental Manufacturing Co.	4
Others	6
	100 %

Sources: Chemical Week 6.2.65
USA visit reports, A.L.Cornford

(ii) Medical Oxygen

The main USA producer is Airco. Other known producers are : S.S.White Dental Corporation, Burdett, Liquid Carbonic and Whitmore Oxygen Co. Puritan-Bennett are distributors only. Market shares are not available.

Section 16(b)

COMMERCIAL FACTORS

In general, medical hardware companies do not sell medical gases as agents.

Air Products - sell medical gases but tend to concentrate on selling liquid oxygen to hospitals. Where necessary they buy nitrous oxide from the nearest and cheapest source. Soon all divisions of AP may be selling medical equipment.

Ohio - have two nitrous oxide plants in Cleveland, Ohio, and Berkeley, California. They truck the liquid N_2O to the filling stations. Ohio supply and deliver compressed oxygen themselves; liquid is supplied and delivered by Airco, but the transaction goes through Ohio's books. VIEs are installed by Airco and rented out to customers.

Airco dominate the medical equipment market and are building a $6 million plant in Madison, to double their capacity.

Puritan-Bennett - have two production plants at Hopewell, Virginia and Galena, Kansas. They are building a 5million lb. plant at Brockville, Ontario. This will be near New York and the New England states. They take liquid ammonium nitrate direct from the chemical plant and convert to N_2O on the site. Distribution is in bulk to filling stations. This prevents the chemical manufacturers entering the N_2O market. Puritan buy oxygen locally.

There are no long-term contracts for medical gases. Hospitals tender for liquid each year, so price competition is keen and suppliers change often.

Source: A.L.Cornford's USA visit notes.

APPENDICES

APPENDICES

1 Acknowledgments

2 Sources of Information

3 Anti-trust

4 Value of shipments by geographic areas

5 Maps

6 Independent Manufacturers

7. Financing Investment in the USA

APPENDIX 1

ACKNOWLEDGEMENTS

The present papers have been compiled over a period of approximately one month (October 1969) but drawing on a variety of written sources and recollected views going back over the years.

Many people in the Group have helped by unearthing papers and answering questions; their help is gratefully acknowledged.

The team that has been engaged almost whole time on the work during October has been Mr Faluah (Business Research Officer), Mr Haley (Overseas Division, who undertook most of the editorial work), Mr Majdalany, (Central Finance), Miss Furst and Mrs Sewell (Commercial Research), Miss Burkinshaw (Commercial Intelligence), and Miss Stokes (on secondment from Market Research Department, specialising in statistics on medical gases and equipment).

Also our very special thanks to the people who typed it, and the people who printed it.

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APPENDIX 2 (a)

SOURCE OF INFORMATION

BOC Internal Reports

	Reference Number
J.L. Harrison to USA and other countries on Non Ferrous Metals 1969	1
R.L.Tickell to Lox Equipment Calif. 1969	2
W. Ford Wexford to CGA meeting and other companies	3
J.A. Farrer-Halls to USA to study design of cryogenic rail cars	4
Report on visit to International Food Freezing Exhibition and Airco (unpublished) by P. O'Brien 1967	5
Visit to Airco on helium and special gases, Ohio Medical products, Matheson, and Cauhel by R.L. Tickell 1967	6
Visit to Airco by Messrs P. Laister, RCH-J and R.W. Broome 1967	7
Food freezing with liquid nitrogen, commercial and technical aspects. H.F. Radcliffe and Dr. H. Danidge 1966	8
Visit to USA, Airco and Linde UC by Messrs W.H. Rogers, R.W. Broome and H.S.Rich 1965	9
Visit to USA by J.A. Gilbertson and W.F. Castle Airco and Union Carbide mainly technical 1965	10
Visit to Linde UC by J.A. Farrer-Halls as LC-3's and other distribution equipment 1959	11
Visit to Linde UC by J.A. Farrer-Halls on LC-3's , 1958.	12
American visit reports by cryoproducts personnel 1965-67	13
Special report by "33" the magazine of metals producing entitled "A Global View At Oxygen And Steel Making" (undated assumed mid 1967)	14
MAPP - Visit to Dow Chemical Co. October, 1967 W.H. Rogers and F.G. Williams	15
MAPP - Visit to USA July 1966 HR/HO/21 I. Greenfield	16
MAPP - Technical catalogue on applications etc. Dow Chemical Co.	17

	Reference Number
LPG - US market survey August 1954 I. Greenfield	18
Union Carbide R & D effort	19
Potential for tonnage oxygen, British commonwealth K.H. Sargeant July, 1958	20
US visit by J.L. Harrison use of oxygen in iron and steel making (two parts), July, 1960	21

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APPENDIX 2 (b)

SOURCES OF INFORMATION

Working Papers

	Working Paper Number
Survey of oxygen plants in USA steel industry.	100
'Inorganics hold rapid pace' Review of US growth 1960-66, C & EN 4.9.67.	101
'Prospects brighter for industrial gases' Review and forecast up to 1974 C & EN 25.8.69.	102
'New technology and products offer challenges' 1965-1969. Review of inorganics, including gases C & EN 1.9.69.	103
Cryogenics Engineering News Index of elemental gas production 1960-66. Cryogenics Engineering News December 1965, page 40.	104
Chemicals and Rubber - US Department of Commerce Business and Defense Services Administration - various numbers 1960 - 1966. Annual reviews of industrial gases scene.	105
Census of Manufacturers 1963 US Department of Commerce. Comprehensive statistical source including employment, value of shipments, geographical distribution of sales, value and volume of shipments of oxygen, nitrogen, argon, acetylene, carbon dioxide, nitrous oxide, helium.	106
Industrial gases - Current Industrial Reports Series M28A, annual supplements and various monthly issues (series M28C) US Department of Commerce, Bureau of the Census - 1965 - 1969. Annual figures for volume and value of production, monthly figures on volume of production, acetylene, CO_2, H_2, N_2, O_2, argon.	107
Helium - The changing market (1964) Gardner Cryogenics Corp.	108
Hydrogen - Cylinder and trailer hydrogen markets in the USA. A. Muller, September 1969.	109
Hydrogen - Notes on total hydrogen market, forecast, liquid capacities etc. P. Falush.	110
Union Carbide - Linde Division. Visit by J.A. Gilbertson December 1965. Useful information on UC's production, distribution, and plant manning practices. Also visit to New Haven plant. Copy of BSR file 'X3 USA reports.'	111

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	Working Paper Number
Air Reduction - Visit by J.A. Gilbertson November 1965. Notes on operating practices, technical details etc. Copy on HSR file 'X3 USA reports.'	112
Mathoson - Visit by R.L. Tickell July 1965. 5 page report on scope, competition and distribution methods of company. Copy on HSR file 'X3 USA reports.'	113
Predicast - The USA cryogenics gas industry No. 35 - May 1964 covering O_2, N_2, Ar, H_2, He. End use analysis and forecasts and methods of delivery.	114
Predicast - The USA cryogenics industry No. 45 July 1967.	115
Compressed Gas Association - The future of the compressed gas industry. Papers of meeting January 1968.	116
Industrial Gases - SR1 long range planning reports No. 289, July 1966.	117
US Welding industry. Collection of articles on welding industry and distributors, statistics and case histories. Various issues of "The Welding Distributor".	118
N_2 in food - Collection of press cuttings from Cryogenic Engineering News on nitrogen applications.	119
NASA - Collection of press cuttings on NASA cryogenics applications.	120
USA Gases environment. Notes of meeting on H.S.Rich and A. Huller, October 1969.	121
US Industrial gas market - Notes by J.B. Sutherland (Afrox) on US data October 1969.	122
US Acetylene, DA and Carbide market - Collection of rough working papers, including international comparison.	123
US Oxygen in steel industry. 21 mill tons of O_2 - article in 'Iron & Steel Engineer' October 1966.	124

	Working Paper Number
US Merchant O_2/N_2 facilities. Airco information December 1967.	125
US Industrial gas industry review. Chemical week 27th September 1969.	126
US Helium - Collection of papers and press items on helium, including Bureau of Mines items.	127
US Collection of items on CO_2 market.	128
US and UK Collection of items on use of argon and nitrogen in steel industry.	129
US Collection of papers on oxygen application.	130
US Collection of LP gas and ethane statistics.	131
US Estimates of US on-site tonnage capacity 1965.	132
US Oxygen pipelines - Article in 'Oil & Gas' journal, 16.12.68.	133
US Miscellaneous information on carbon monoxide (see also 133).	134
US Company acquisition by industrial gases firms.	135
Oxygen in the steel industry - Collection of papers on development of O_2 in US industry, international comparisons, price and volume forecasts up to 1975, share of major suppliers and capacity, forecasts of specific consumption.	136

APPENDIX 2 (c)

PUBLISHED SOURCES OF INFORMATION

Cryogenic Engineering News

Cryogenic Information Report

Chemical & Engineering News (Now Cryogenics & Industrial Gases)

Oil & Gas Journal

The Commercial Intelligence Competition data sheets

"Airco Ink" Airco House Magazine.

Company Published Annual Reports

See also:-

Chemicals Division Files on Industrial Gases

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APPENDIX 2(d)

REFERENCE MATERIAL ON MEDICAL GASES

1 Article in Chemical Week, 6.2.65. Page 51

"Why Laughing Gas makers Grin"

2 SRI Report on Industrial Gases, June, 1966

3 USA visit reports :-

Harris Calorific	10.7.67	-	A.L. Cornford
	14.6.68	-	" "
	15.11.68	-	D.W.E. Stafferton
Puritan-Bennett	16.6.65	-	A.L. Cornford
	10.12.67	-	" "
	24.6.68	-	" "
Ohio (AIRCO)	18.6.65	-	A.L. Cornford
	2.11.67	-	R.L. Tidnall
	10.12.67	-	A.L. Cornford

4 USA Current Industrial Reports

APPENDIX 3

Extract from : THE FINANCIAL TIMES, 7th October 1969

Berger Proposals :

US DEPARTMENT OF JUSTICE RAISES AN INTERNATIONAL ISSUE

BY CHRISTOPHER TUGENDHAT

DURING the past dozen or so years U.S. companies have been engaged on an increasingly large scale in European industry. Between 1957 and 1967, the latest year for which figures are available, the book value of their investments in Europe increased by a phenomenal 337 per cent. to $17½ bn. In the past two years there has been a further substantial rise.

Although it was once hoped to believe, the value of Europe's direct investments in the U.S. was greater than those of the U.S. in Europe until 1957. But since then Europe has been left far behind. At the end of 1967 the European stake in the U.S. was worth only just over $7 bn.

It is against this background that Europeans must inevitably regard the difficulties confronted by Mobil Petroleum in its efforts to strengthen its position in the U.S. through a merger with Standard Oil of Ohio, usually known as Sohio.

Growing concern in Europe

The implications of Mr. Berger's problems with the anti-trust division of the Department of Justice extend far beyond the interests of the two companies involved. The case is being watched with mounting concern by all European companies thinking of either establishing a position in the U.S. or extending an existing one through a merger or take-over.

An example of this was provided last week by Sir Peter Allen, the chairman of Imperial Chemical Industries, at a Press conference in New York. After revealing plans for a petrochemical plant in Virginia, he was asked whether ICI might consider a major acquisition in the U.S. "We are fairly keen on the interest in what BP are and are not allowed to do," he replied.

If BP was the first example of a major European company which U.S. interests have run into trouble with the Justice Department, the present concern will not be so great. But it will.

In 1958 the German chemical combine, Hoechst, established a joint venture with the U.S. Celanese Corporation to manufacture and sell a range of chemicals and other products in the United States and other countries. Hoechst agreed to buy out Celanese's share of the business in 1967. By that time Celanese had become the target of a take-over bid by Messrs. Charles Pfizer, the U.S. pharmaceutical group. Pfizer was forced to withdraw its bid following a Consent Decree Memorandum signed by the Department's Assistant Attorney General in charge of anti-trust matters, Mr. Richard W. McLaren.

Not surprisingly, the impression is beginning to gain credence that for all its condemnation of the economic machinations of de Gaulle, the U.S. will not allow foreign concerns a clear run over the region to present a serious challenge. Memories of the way in which Courtaulds subsidiary, the American Viscose Corporation, was founded between the wars and eventually nationalised by a U.S. syndicate in 1940 in a virtually forced sale at a knock-down price in exchange for hard-to-get sterling revived.

In these circumstances it is important to avoid the pitfalls of nationalism and emotionalism. U.S. investment in Europe, the policies of the Department of Justice, and the position of European companies in the U.S. must all be considered in a cool and rational light.

U.S. direct investment has in the past proved extremely valuable to the countries of Europe. In the immediate post-war years it helped them to replace imports, and it rebuilt their shattered economies. More recently it has helped governments to develop the less favoured regions of their countries, such as Northern Ireland and the South of France.

Some governments, of which Belgium is a notable example, have come to rely so much on U.S. companies for their industrial investment and the modernisation of their economy that as soon as the U.S. Government imposed mandatory restrictions on overseas capital investments, they pressed for help the companies could find alternatives.

Another point to remember is that the governments, especially those of the developing countries, are very keen to get the maximum benefit to the balance of payments out of the inflow of capital that follows a U.S. take-over or a joint venture.

Less need for U.S. investment

[illegible] of U.S. [illegible] Europe [illegible] to [illegible] Government [illegible] Europe [illegible] by [illegible] the [illegible] investment [illegible].

Europe would be well to cut off its nose to spite its face by stopping a rationalistic hostility to continued U.S. investment. But having said that the fact remains that European governments cannot be expected to maintain the open door policy that exists in most countries if European companies are to be restrained from mounting an effective challenge in the U.S.

Valuable as U.S. investment is, the need for it is now much less than it used to be. Moreover, it would be quite feasible for governments to adopt a more selective policy by discriminating between companies that can make a special contribution, such as those which bring a new technology or are prepared to take over an ailing local concern like Rootes or Machines Bull, and the rest. The majority of U.S. companies, including those that are already here as well as those considering coming, fall into the latter category.

The State Department and the great U.S. international companies are fully aware of these far-reaching implications to the Sohio case. The problem lies with the Department of Justice. It is not concerned with the relationship between the U.S. and other countries [illegible] overseas interests of U.S. companies, although American public policy, which Congress and these factors will no doubt one day be entirely ignored in its deliberations. Its criteria are legal.

When the Department last week filed its anti-trust suit against the proposed merger between BP and Sohio, Mr. Richard McLaren, the head of the anti-trust division, set out his attitude to life with clearness. "In evaluating this merger," he said, "we regarded BP no more and no less favourable treatment than we would give an American oil company in BP's position."

There is no reason to doubt his word. Nothing the Department has so far done suggests that BP's home country is treated any more than Ital or any of the other large U.S. companies who are at present in dispute with the anti-trust division of the Department over it. The division is extremely able, and it is also protected against over-zealousness. But it is [illegible].

If it is wrong, in order at any rate an indication of [illegible] should be pointed out. In London over the weekend, the company's chairman, Mr. Eric Drake, said that "All the legal

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advice we have received is that the proposed amalgamation of BP with Sohio does not contravene the anti-trust legislation as enacted by Congress and interpreted by the U.S. courts."

This may be so. But legal advice available to others suggests that it has been apparent for some time that the deal was likely to run into trouble with the anti-trust division. Some lawyers have been prepared to offer a definite opinion that the deal would not be allowed to go through. Others have disagreed, and said that it would, but they too have seen serious obstacles.

Top 200 U.S. companies

BP must have realized this if it examined the address made by Attorney-General John Mitchell on June 6, 1969, when he declared that the Justice Department would "probably" attack any merger combining two companies among the top 200 manufacturing companies, and any acquisition by one of the top 200 or a leading company in a concentrated industry.

Sohio is 111th in assets, 130th in sales and the leading company in its own market. On a world basis BP's assets and sales would put it in the top 25. Even if its non-U.S. interests are excluded from the reckoning, which the Department has probably done, it is still caught. The properties it took over from Sinclair earlier this year put it about 170th in terms of assets, and 119th in terms of sales. If the Alaskan oil reserves are thrown into the pot, as they should be, then BP's U.S. subsidiary becomes a giant in its own right, even though it would be very short of cash if the Sohio deal falls through.

Having established the persons for the Department's interest, the proposed merger must be examined under two heads—1. The threat to existing competition, and 2. the threat to potential competition.

On the score of existing competition there is not much to worry about. The two companies [illegible] Western Pennsylvania, which could easily be dealt with.

[illegible]

party would in any case expand into the other's market so that a merger would reduce competition in the future.

This means that BP and Sohio must each show that they would not be likely to expand into each other's markets if they remain apart. It is because they believe that BP's resources, and its Alaskan oil, would in reality lead it to move into Sohio's field [illegible] that some lawyers are of the view that the deal will fall through. If BP can show that this reasoning is false its chances of success will be much improved.

As things stand there is not too much cause for gloom. Talks have been going on between the companies and the Department for some time. So the fact that the Department is not seeking to prevent the Sohio shareholders' meeting due for Thursday, or the exchange of stock due on Friday, is encouraging. But it remains to be seen whether the Department demands such onerous conditions as to lead the companies to call the whole thing off.

The tragedy of the situation is that the anti-trust legislation was devised in order to encourage competition in the U.S. Yet the manner in which it is being implemented is having the effect of deterring European companies from entering the U.S. and so [illegible] with it a completely fresh wind of change.

Discrimination policy

When American companies come to Europe they are normally larger and richer than their foreign opposite numbers and large in relation to the national [illegible] they are subsidiary. So they can either take over an existing concern (ICI, Stock and Bovril, or start a greenfield operation without any local [illegible].

European companies going to the U.S. are in a much weaker position. They tend to be small in relation to the American market, and even in the case of BP and Shell in comparison with the U.S. giants. They also tend to be [illegible] by the size of their operations [illegible] Britain or Europe, so [illegible] [illegible] [illegible]

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APPENDIX 4

USA - INDUSTRIAL GASES

VALUE OF SHIPMENTS BY GEOGRAPHIC AREA - 1963

USA - INDUSTRIAL GASES

VALUE OF SHIPMENTS BY GEOGRAPHIC AREA - 1963 (1)

Area	ACETYLENE (3) ($ million)	CARBON DIOXIDE ($ million)	ELEMENTAL GASES (2) ($ million)	TOTAL INDUSTRIAL GASES (4) ($ million)
United States, total (1)	93.5	49.9	244.6	388.0
New England	1.5		6.3	7.8
[illegible]		14.6		14.6
Middle Atlantic	18.3		48.5	66.8
[illegible]			4.4	4.4
[illegible]	1.7	7.5	8.5	17.7
[illegible]			35.5	35.5
East North Central	13.3	10.0	63.6	86.9
[illegible]	6.5		28.4	34.9
[illegible]	1.2			1.2
[illegible]	2.6		15.3	17.9
[illegible]	2.0			2.0
West North Central	2.9	7.1	13.9	23.9
[illegible]			3.4	3.4
[illegible]			8.8	8.8
South	51.1	10.2		61.3
[illegible]		2.2	19.2	21.4
[illegible]	1.1			1.1
[illegible]	1.0		1.4	2.4
[illegible]	2.0		3.0	5.0
[illegible]		3.9		3.9
[illegible]			25.0	25.0
[illegible]			9.1	9.1
[illegible]			8.1	8.1
[illegible]			2.4	2.4
Florida			14.7	14.7
East South Central			3.8	3.8
[illegible]			7.1	7.1
[illegible]			22.8	22.8
West South Central			4.9	6.4
[illegible]	1.5		2.8	2.3
[illegible]			45.0	49.9
Mountain	4.9		39.2	47.9
California	3.2	5.5	1.4	1.4
[illegible]				8.0
[illegible]		8.0		

(1) The absence of figures in the table does not imply no business in the area, it reflects only that the Census data omitted it because it falls below $1.0 million.

It is for the same reason that the total is more than the sum of the figures for the States enumerate.

(2) Includes all atmospheric gases as well as helium and hydrogen.

(3) Acetylene made for all uses, including chemicals.

(4) Includes all atmospheric gases, acetylene, CO_2 and helium produced and sold by non-government establishments.

[illegible] 'Value of Shipments', as defined by census returns as sales to third parties. Final sales value therefore may be substantially higher if it is resold by [illegible] distributors. Distributors of industrial gases are not classified under the [illegible] (SIC 2813) category.

Source: Department of Commerce Census of Manufactures 1963

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APPENDIX 5

MAPS

a AIRCO

b Air Products

c American Cryogenics/Dye Oxygen/Industrial Air Produ

d Big 3

e Burdett

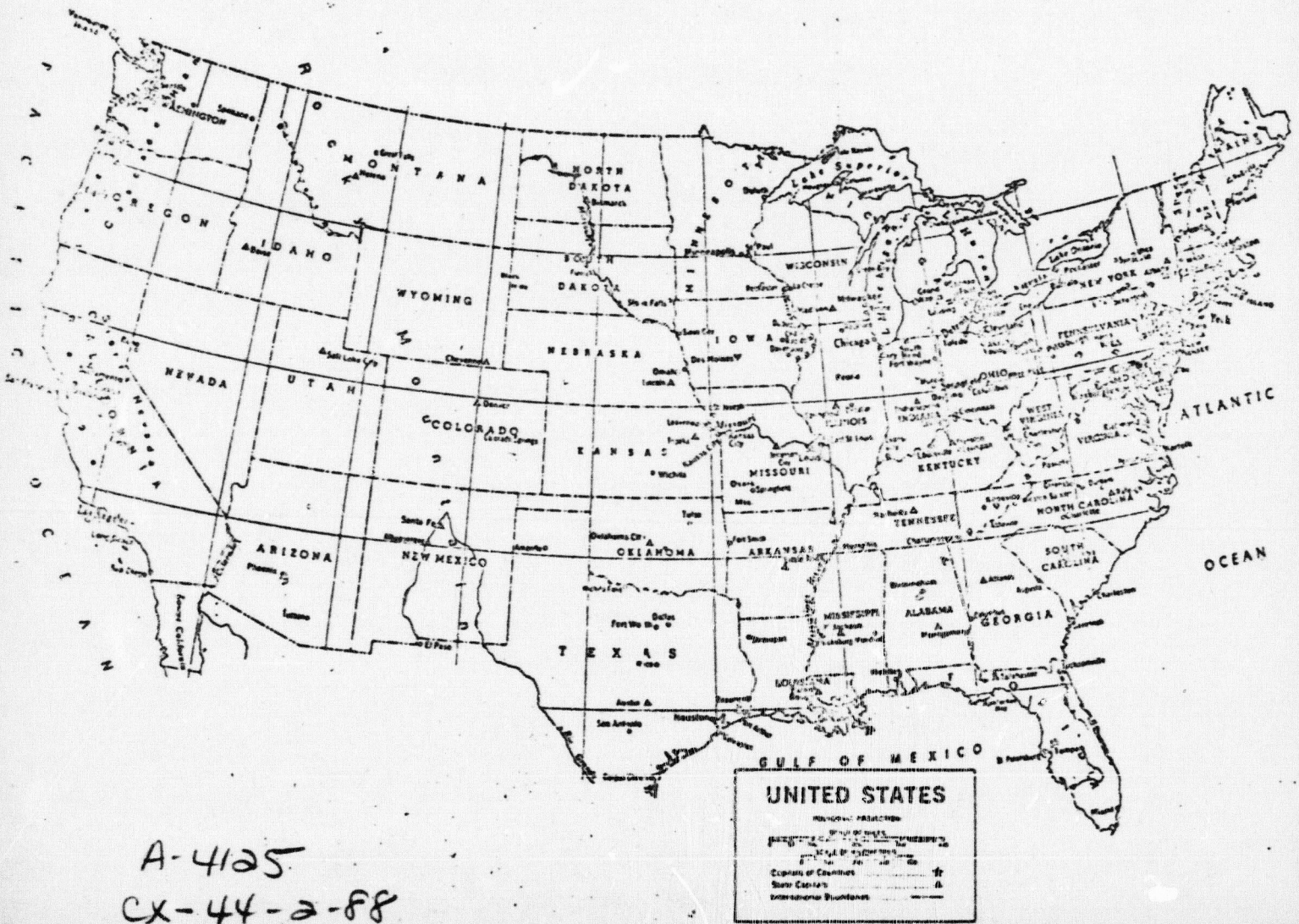
f Liquid Carbonic (Houston Natural Gas)

g National Cylinder Gas

h Union Carbide - Linde Division

AMMONIUM NITRATE FACILITIES BELIEVED TO BE SERVING MERCHANT MARKET

PLANTS OVER 1,000 TPD SHOWN THUS = (4)



UNITED STATES

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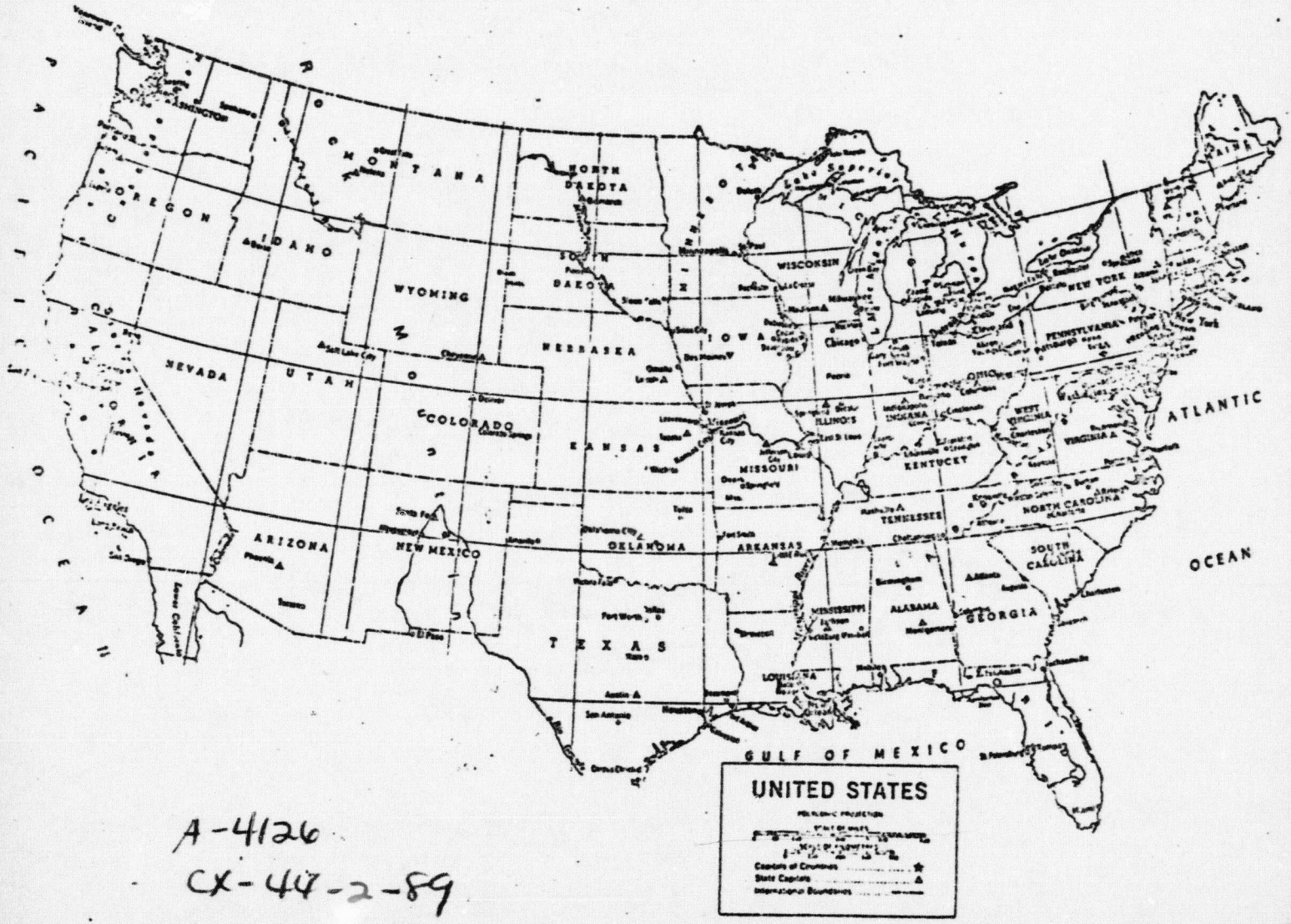
AIR PRODUCTS TONNAGE FACILITIES BELIEVED TO BE SERVING MERCHANT MARKET

PLANTS OVER 1,000 TPD SHOWN THUS ★



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Annex 7(c)
American Cryogenics
Dye Oxygen
Industrial Air
Products

AMERICAN CRYOGENICS/DYE OXYGEN/INDUSTRIAL AIR PRODUCTS - PRODUCTION CENTRES

N.B. To avoid confusion please note that none of these plants is over 1,000 tpd

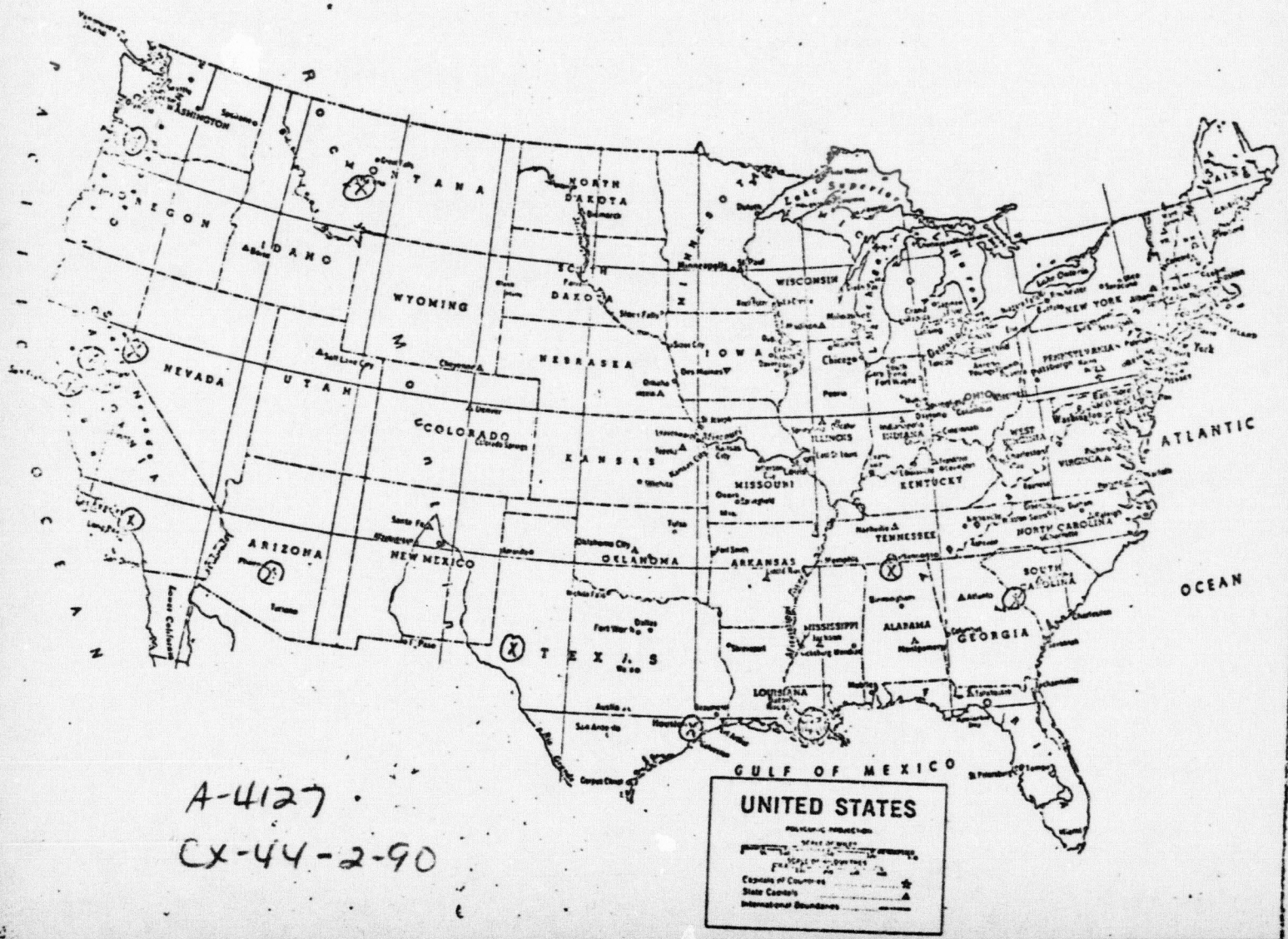

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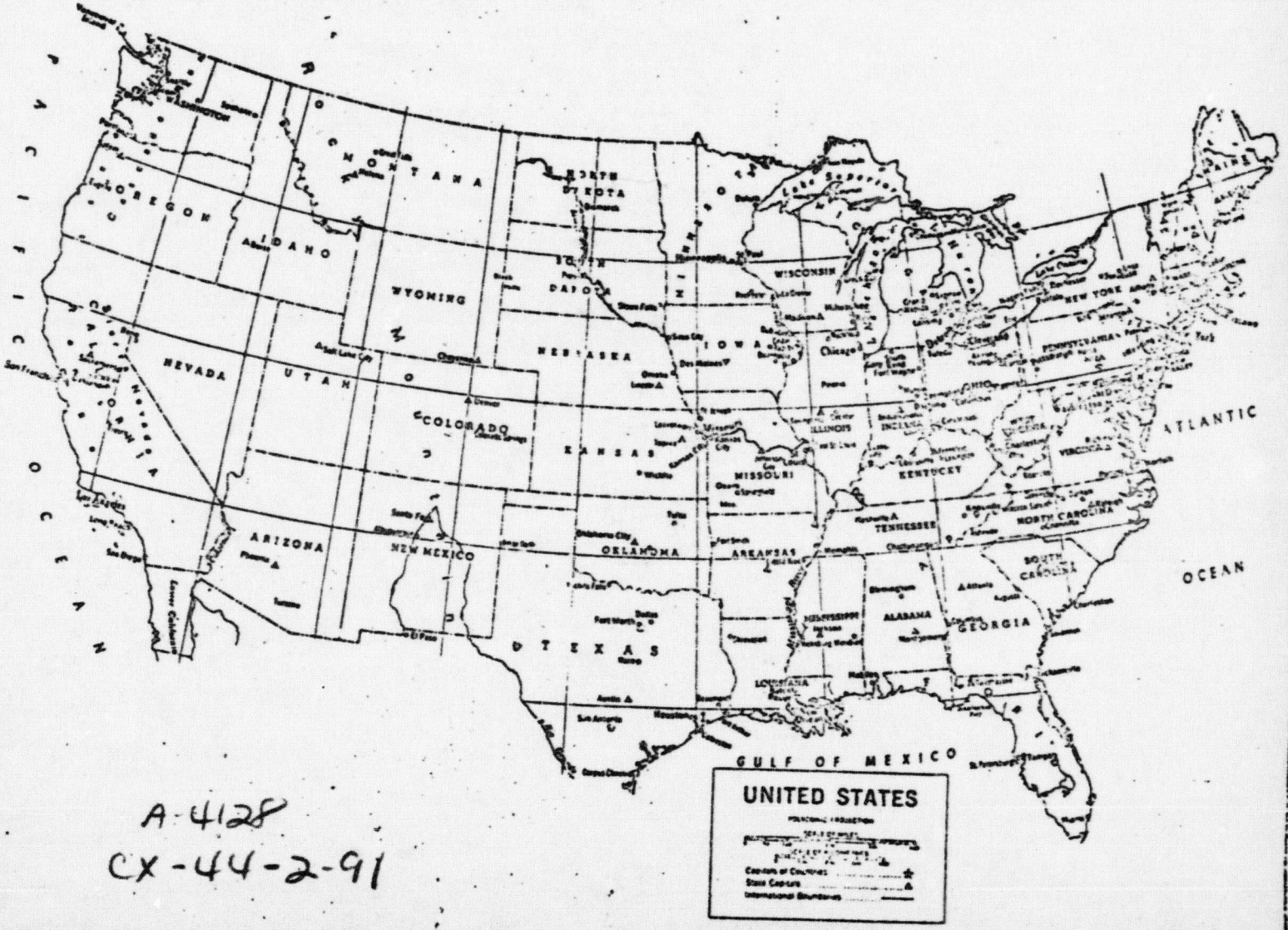
FIG 3 - MAJOR PRODUCTION CENTERS



A-4128
CX-44-2-91

A

DUNDEE - MAJOR PRODUCTION CENTERS

A 4129

CX-44-2-92

LI.410 CANDOYIC - MAJOR OXYGEN PRODUCTION CENTERS

A-4130
CX-44-2-93

NATIONAL CYLINDER GAS - MAJOR PRODUCTION CENTRES

A-4131
CX-44-2-9B

UNION CARBIDE TONNAGE FACILITIES BELIEVED TO BE SERVING MERCHANT MARKET

PLANTS OVER 1,000 TPD SHOWN THUS = ⊙

A-4132.
CX-44-2-95

CX-44-2-76

APPENDIX 6

INDEPENDENTS

APPENDIX 6

INDEPENDENT MANUFACTURERS

In the time available we have been able to identify the following independent manufacturers. We believe that in actual fact there are approximately between 60-100 across the USA.

Manitowoc Gases, Manitowoc, Wisc.) These have the
Manitowoc Oxygen, Manitowoc, Wisc.) same directors but
Northern Oxygen, Milwaukee, Wisc.) trade independently.

Amarillo Oxygen, Amarillo, Texas .
Kansas Oxygen, Hutchinson, Kansas.
Energy Gases, East Syracuse, NY.
Narox, Hopwell, Va. (jointly owned by Burdett, PPC & National Welders Supply)
Superior Air Products, Newark, NJ.
Whitmore Oxygen, Salt Lake City, Utah.
Thermice Corporation, Philadelphia, Pa.
Welders Supply Inc., Cleveland, Ohio.) not
Welders Supply Co., Little Rock, Arkansas) connected.
NL Curtis Co., N. Hollywood, California.
Acetylene Gas Co., St. Louis, Missouri.
Pacific Oxygen Co., Oakland, California.
Acetogen Gas Co., Detroit, Michigan.
Tyn's Co., Inglewood, California.
Mingo Oxygen, Mingo Junction, Ohio.
Alabama Oxygen, Birmingham, Alabama.
Selox Inc., Chattanooga, Tenn.
Gulf Oxygen, Lake Charles, La.
Merritt-Holland Welding, Wilmington, North Carolina.
East Texas Oxygen, Tyler, Texas.
National Welders Supply, Charlotte, North Carolina.
Evans Air Products, Tompkinsville, NY.
Carbide Reduction, Linden, NJ.
AllState Gases, Travis, NY.
Cryogenic Rare Gas Laboratories, Newark, NJ.
Indiana Oxygen, Indianapolis, Indiana.
Puritan Bennett, Kansas City, Missouri. (mainly medical)

A 4135

CX-44-Z-58

APPENDIX 7

FINANCING INVESTMENT IN USA -
NOTES ON L'AIR LIQUIDE AND ICI

A 4136

CX-44-Z-77

APPENDIX 7

FINANCING INVESTMENT IN USA -
NOTES ON L'AIR LIQUIDE AND ICI

L'Air Liquide

L'Air Liquide Board obtained shareholders' authority (June 1969) to extend the amount the company could raise by rights issue from £12 million to £23 million.

New finance facilities arranged in 1968 include £5 million long term bank loan, £4 million Credit Lyonnais facility and £7 million long term Belgian credit from the Societé Nationale de Credit a L'Industrie. Little use had been made of these credits by end 1969.

Total facilities of £59 million(approximately $93 million)were earmarked for expansion in the United States and Belgium.

Of the $50 million acquisition price for American Cryogenics, Industrial Air Products and Dye Oxygen, at least $10 million will not be required immediately in cash. This sum represents 70% of the Schnitzer family former interest in Industrial Air Products being met by deferred payments over eight years.

L'Air Liquide, being outside the sterling area, is not handicapped by the restrictions on capital transfers and fund raising, and the level of return requirements, imposed on a UK company investing in the USA.

ICI

ICI investment in the non sterling area is estimated at over £500 million (of which approximately £100 million each is in the USA and Canada). UK exports (f.o.b.) to the non sterling area were £150 million in 1968. The £100 million American investment was built up over 18 years from 1950.

The above has been financed out of retentions, local subsidiary borrowings and UK stake without recourse to local equity issues. (The Amsterdam quotation is a listing of UK stock. ICI are not listed on American stock exchanges).

The UK stake is currently represented by a $30 million 6¾% Eurodollar bond and three Swiss 10 - 15 year placings (one unsecured) at 4½ - 5¼%, totalling £27 million. Redemption of these loans can be made in sterling at the official rate of exchange.

This means that together with additional 5 year Euro-borrowing facilities (unspecified in the accounts), the UK stake over an 18 year period could have provided up to a third of the overall investment, had this been required, leaving an overall third each provided by local borrowings and retentions.

CX-45A

A 4137

Still Hollow Road
Lebanon, N.J. 08833 USA

December 1, 1969

Mr. L. E. Smith
The British Oxygen Company, Ltd.
Hammersmith House
London, W. 6,
ENGLAND

Dear Leslie,

Following my visit to London in October and the new policy and instructions reviewed at that time regarding BOC's present limited interests in acquisition/joint ventures in the U.S., I have now contacted all of those organizations with whom active propositions were being developed and have terminated all negotiations. I have also informed my various management level contacts in industry, banking, investment and consulting that BOC no longer has interest in acquisitions or joint ventures in the US. at this time, except possibly in the industrial gas area. I have made every effort to avoid adversely affecting BOC's credibility and reputation in the above regard, against a possible reaction of interest in the future. I am reasonably confident that my explanations have been fairly accepted by the majority of those with whom I have dealt and that a program of search can be re-established without the necessity of "ground-breaking" as was the case a year or so ago. Naturally, I am still puzzled by your change in attitude regarding the U.S., since I have had only a rather superficial explanation of the reasons for the change. Anything further that you feel free to tell me in this regard will be both helpful and appreciated.

In addition to the above the following items were handled as part of last month's activity.

1. Further discussions were held with Prof. J. V. Foa of the Rensselaer Polytechnic Institute with regard to the "energy-separation" he has developed for producing refrigeration. Some of the data received are already in the hands of Dr. J. B. Gardner.

2. A commercial relationship has been discussed with Mr. Jerome Robinson, president of Uni-Bronze regarding his interest in selling BOC welding products under his brand name. Mr. Dennis Thorp of the Equipment Group has met with Mr. Robinson and will be reporting on this subject in detail to Mr. Rickett. One important new development in the situation is that Mr. Robinson is starting a welding products business in the U.K. as of December 1.

3. A preliminary discussion has been held with Mr. Donald Grenier of Premier Industrial Corporation, Cleveland, Ohio, regarding the interest of this company in selling BOC welding products in the U.S. This was a follow-up to a direct inquiry made to BOC by Premier some time ago. Interest is still high and Mr. Grenier expects to visit Mr. Reckitt on this matter in January if the necessary arrangements can be made.

4. A further meeting was held with American Sterilizer Company, Erie, Pa., primarily to terminate further discussions relating to acquisition/joint venture negotiations. After this matter was disposed of, AMSCO expressed interest in a commercial relationship with BOC which would enable them to sell Boyle machines, respirometers, etc. in the U.S. and inquired as to BOC interest in selling AMSCO sterilizers, operation tables, surgical lights, etc. in the U.K. As far as the US situations is concerned I have referred them to Steve Taylor at Harris. In a recent letter to Mr. C. Hesketh-Jones I informed him of the U.K. situation and would like to hear back on this matter as soon as possible.

5. Preliminary study has been given to technical and marketing matters where information has been requested. These include:

(a) Ion implantation techniques.
(b) New refrigeration techniques.
(c) Mechanically refrigerated cold traps for vacuum systems.
(d) Market for aluminothermic chromium in the U.S.
(e) Adhesives for joining metals.
(f) Vacuum brazing alloys.

Invoices for my expenses for the period October 16 - November 15 inclusive, and my consulting fee for November are attached.

With best regards,

Very truly yours,

A. Muller

AM/nd
cc Mr. C. Hesketh-Jones (same address)
Mr. J. A. Perham
Canadian Oxygen Limited
355 Horner Avenue
Toronto 14, Ontario, Canada

A 4139 CX -46

Still Hollow Road
Lebanon, New Jersey 08833 USA

November 19, 1969

Mr. R. C. Hesketh-Jones
British Oxygen Company
Hammersmith House
London W6, England

Dear Cris:

A few days ago, I visited the American Sterilizer Company, Erie, Pa., for further discussions with respect to possible commercial relations with BOC in the medical products area. As you know, they are interested in selling the Boyle anesthesia machine in the U.S. and have expressed interest in learning whether BOC is interested in marketing their sterilizers in the UK.

In connection with the U.S. situation, I have referred them to Steve Taylor at Mr. Perham's request. I believe they are going to contact Harris on this matter within the next few days. In the meantime, I shall appreciate some word from you as to the possible interest BOC may have in selling sterilizers in the UK market.

While I was visiting American Sterilizer, their Mr. Donald C. Schaper, General Manager, Amsco International Co., asked me whether BOC still had a controlling interest in SACCAB, s.p.A., Italy. Apparently, he has been in touch with this organization with respect to their desire to sell sterilizers in Italy. I told him that I was not familiar with SACCAB and that I would write you informing you of this situation. He will be writing you within a few days on this matter. My purpose in mentioning this situation is merely to apprise you of the fact that you will be contacted by Mr. Schaper in due course.

With kindest personal regards,

Yours sincerely,

s/ A. Muller
A. Muller

AM-es
cc-Mr. J. A. Perham
Canadian Oxygen Limited
355 Warner Avenue
Toronto 14, Ontario
Canada

CX-47-A

A 4140

THE BRITISH OXYGEN COMPANY
LIMITED
HAMMERSMITH HOUSE LONDON W6
RIVERSIDE 2020 TELEX 22833 BRITOXYGEN LONDON W6

3 December 1969
LES/ES

Dr A. Muller,
Still Hollow Road,
Lebanon,
New Jersey 08833, USA.

Dear Al,

Many thanks for your letters of 21 October and 1 December. Let me first deal with the major theme of both letters, ie the apparent change in BOC attitude towards the US market.

I say "apparent" deliberately, because we have not changed our fundamental belief that we should be represented in that market which provides 50% of the free-world demand in most trading areas. What has been lacking, of course, is a strategy of what, how, when and where. We are still groping for answers, but some progress was made at our BOCI conference of October, at which Allan Perham presented his preliminary views followed by discussions at length.

What emerged was that, since it was clearly impossible to study all possibilities at the same time (both study resources and follow up resources were inadequate), we had to impose some discipline to our approach. Product areas had to be studied in order and parameters set, in terms of size and anticipated return on investment, for a BOC interest. In selecting the first area for examination, most thought turned naturally to that where we are most experienced, ie Gases and related products. The study is now well in hand and all resources, including your assistance, are being addressed to it.

From the study, we hope (a) to learn more of what is happening in the USA market, and of the lessons which might be drawn for application in our own markets, and (b) to identify possible development opportunity. If we fail in that identification, the study will still have been worthwhile and we shall then switch our study resources to another product area.

I /

I hope this brief explanation suffices but I am sure Allan Perham will fill any gaps. I had hoped to talk to you myself about the problem but, unfortunately, there was no time whatever on the occasion of your last visit to London.

Referring again to your letter of 21 October, I have covered Note 1 (Acquisition/Joint Venture area). On Note 2 (Technology), John Williams is considering this area and will be in touch with you shortly. On Note 3 (Commercial activity), you may take it that both efforts should be subordinated to assistance in the main exercise of the Gases study. I anticipate that both Bill Smith and Norman Reckitt will be cancelling their requests shortly. On Note 4 (Miscellaneous), all three matters noted have direct or indirect connections with the Gases study and should be continued.

I think most matters contained in your letter of 1 December have also been covered. Obviously, the contacts with Uni-braze and Premier Industrial have to be maintained to the point where Norman Reckitt takes over the direct relationship and is in a position to reach a decision regarding the sale of BOC products in the USA. On AMSCO, Chris Hesketh-Jones returns from a lengthy overseas tour at the end of this week and should be ready to discuss with you shortly afterwards.

Regards,

Yours sincerely,

Leslie Smith

(Leslie Smith)

A 4142

CX-43-A

Still Hollow Road
Lebanon, New Jersey 08833
U.S.A.

December 19, 1969

Mr. L.E. Smith
The British Oxygen Company Limited
Hammersmith House
London W. 6, England

Dear Leslie:

This will acknowledge and thank you for your letter of December 3rd. I am pleased to learn that you have not changed your thinking with respect to participating in the U.S. market. I have reviewed this matter with Allan Perham and feel that the approach we are now following makes good sense, particularly since it will enable a comparison of the opportunities in various product areas to be made. This in turn should permit informed decisions to be reached with regard to investments in the U.S. at the appropriate time.

During the past month I have confined my activities to several small items that needed further attention, and to the task of gathering background data for the industrial gases study. The small items included further investigation of the chromium metal market, the development of a potential source of structural adhesives for the Welding Products Group, and a further investigation of the Foa energy-separator (refrigerator). Each of these subjects will be reported directly to the appropriate parties in BOC in due course.

John Williams recently wrote me regarding the status of several technical matters. Apparently none of the subjects, which were under consideration, are important enough to warrant further direct action. Accordingly, all activity in these areas has been discontinued as of this date.

Invoices for my expenses for the period November 16-December 15 inclusive, and my consulting fee for December are enclosed.

With best wishes for the Holiday Season,

Very sincerely yours,

Albert Muller

AM/tk
cc: Mr. J.A. Perham
Mr. R.C. Hesketh-Jones
Mr. J.M. Williams

A 4143 CX-48-B

From: A. Muller
Still Hollow Road
Lebanon, New Jersey 08833
U.S.A.

December 19, 1969

To: The British Oxygen Company Limited
Hammersmith House
London W. 6
England

Expenses for period
November 16 - December 15 inclusive

Travel	$575.99
Telephone and Communications	67.42
Part time Secretarial service	72.45
Miscellaneous office expense	36.75
Total	$753.61

A. Muller

A. Muller

A4144 CX-43-C

From: A. Muller
Still Hollow Road
Lebanon, New Jersey 08833
U.S.A.

December 19, 1969

To: The British Oxygen Company Limited
Hammersmith House
London W. 6
England

Consulting fee for December 1969 $2,750.00

A. Muller

CX-49-A

A 4145

AGREEMENT

AGREEMENT dated as of 22 July 1971 between THE BRITISH OXYGEN COMPANY LIMITED, an English corporation ("BOC"), and AIR REDUCTION COMPANY, INCORPORATED, a New York corporation ("Airco").

W I T N E S S E T H :

WHEREAS, BOC and Airco each owns 50% of the issued and outstanding stock of BOC-AIRCO Cryogenic Plant Limited, an English corporation ("BocAir"), which capital stock consists of 750,000 ordinary shares having a par value of £1 per share, divided into 375,000 "A" shares and 375,000 "B" shares, 225,000 "A" shares of which have been issued and are owned by BOC and 225,000 "B" shares of which have been issued and are owned by Airco; and

WHEREAS, Airco desires to sell and BOC desires to purchase all of the BocAir shares owned by Airco on the terms and conditions hereinafter described,

NOW, THEREFORE, in consideration of the premises and the agreements and covenants hereinafter contained, the parties hereto agree as follows:

ARTICLE I

A. BOC represents and warrants that:

(1) BOC is a corporation duly organized, validly existing and in good standing under the laws of the United Kingdom and has the corporate power to enter into this Agreement and to perform the transactions contemplated hereby.

(2) Neither the execution and delivery of this Agreement nor the consummation of the transactions herein contemplated will conflict with, or result in a breach by BOC or BocAir of, any of the terms, conditions or provisions of, any law, regulation, order, writ, injunction or decree of any court or governmental instrumentality, domestic or foreign. Neither the execution and delivery of this Agreement nor the consummation of the transactions herein contemplated will conflict with, or result in a breach by BOC or BocAir of, any of the terms, conditions or provisions of, any loan agreement, indenture or contract to which BOC or BocAir

is a party, or of the Memorandum and Articles of Association of BOC or BocAir.

B. Airco represents and warrants that:

(1) Airco is a corporation duly organized, validly existing and in good standing under the laws of the State of New York and has the corporate power to enter into this Agreement and to perform the transactions contemplated hereby.

(2) Airco is the lawful owner of 225,000 "B" shares of BocAir constituting 50% of the issued and outstanding shares of BocAir and has valid and marketable title to such shares, free and clear of all claims, liens or encumbrances, and full legal right and power and all authorization and approval required by law to sell, assign and transfer such title to such shares to BOC as provided in this Agreement.

(3) Neither the execution and delivery of this Agreement nor the consummation of the transactions herein contemplated will conflict with, or result in a breach by Airco of, any of the terms, conditions or provisions of, any law, regulation, order, writ, injunction or decree of any court or governmental instrumentality, domestic or foreign. Neither the execution and delivery of this Agreement nor the consummation of the transactions herein contemplated will conflict with, or result in a breach by Airco of, any of the terms, conditions or provisions of, any loan agreement, indenture or contract to which Airco is a party, or of the Articles of Incorporation or By-laws of Airco.

ARTICLE II

A. A closing with respect to the transactions described in this Article II (the "Closing") shall be held on 1 October 1971 or such other date as may be mutually agreed in writing by Airco and BOC (the "Closing Date"). The Closing will be held at the offices of BOC, Hammersmith House, London, W.6., at 11.00 a.m.

B. At the Closing on the Closing Date:

(1) Airco will sell to BOC 225,000 "B" shares of BocAir stock, free

and clear of all claims, liens and encumbrances of any kind. Airco will deliver a certificate or certificates for such shares to BOC in proper form for transfer, duly endorsed in blank or with duly executed assignments to BOC attached. Such certificate or certificates shall be accompanied by all documents necessary to support the transfer to BOC. All required stock transfer stamps shall be supplied by BOC at BOC's expense and BOC shall bear all similar costs and expenses relating to such transfer. BOC will pay for such shares in full by delivering to Airco BOC's certified check in the amount of U.S. $640,000.

(2) BOC will execute an Undertaking in the form annexed hereto as Exhibit A.

(3) BOC and Airco will secure the release of Airco from all of its obligations with respect to that certain guarantee from Airco to Midland Bank Limited ("Midland") dated 13 Decembe 1967 with respect to credit and banking facilities afforded by Midland to BocAir.

C. The Parties expressly agree that provided that the Closing takes place in accordance with the terms hereof the business of BocAir from and after the date hereof whether by reason of facts occurring before or after the date hereof shall be regarded as though it were for the account of BOC or as though BOC were the sole shareholder of BocAir to the end that nothing arising with respect to or as a result of such business shall be deemed to affect any of the provisions of this Agreement or to give rise to any obligations or liability on the part of Airco whether as a shareholder of BocAir or otherwise.

ARTICLE III

A. All obligations of each of the parties hereto under Article II of this Agreement are subject to the fulfillment at or prior to the Closing on the

Closing Date of each of the following conditions, except, with respect to either party, to the extent that any such condition has been waived in writing by such party:

(1) There shall have been obtained all consents and approvals of the governments of the United Kingdom and of the United States or of any agency of either of such governments or of any political subdivision thereof necessary or advisable, in the opinion of counsel to either party, to the execution or performance of this Agreement.

(2) On the Closing Date there shall be no litigation or proceeding, pending or threatened, before any court, governmental commission, board or agency, against either party hereto, or BocAir, in which it is sought to restrain or prohibit, or to obtain damages or other relief in connection with, the consummation of the transactions contemplated hereby.

(3) The consummation of the transactions contemplated hereby shall not conflict with or result in a breach by either party hereto, or BocAir, of any of the terms, conditions or provisions of any law, regulation, order, writ, injunction or decree of any court, government or governmental instrumentality, domestic or foreign, nor shall it conflict with any restriction, covenant or contract to which either party hereto, or BocAir, are parties or by which any of them is bound.

B. All obligations of BOC under this Agreement are subject to the condition that, prior to the Closing, BOC's entering into this Agreement shall have been authorized or ratified by BOC's Board of Directors and to the fulfillment at or prior to the Closing on the Closing Date of each of the following conditions, except to the extent that any such condition has been waived in writing by BOC:

(1) All representations and warranties of Airco contained in this Agreement shall be true and correct at the Closing as though such representations and warranties have been made at the Closing.

(2) All covenants and agreements required by this Agreement to be performed and complied with by Airco prior to or at the Closing

shall have been duly complied with and performed by Airco.

(3) BOC shall have received copies of the written resignations of all officers and directors of BocAir nominated by or representing Airco effective as of the Closing Date.

(4) All corporate and other proceedings to be taken by Airco in connection with the transactions contemplated hereby and all documents incident thereto shall be reasonably satisfactory in form and substance to BOC and its counsel and BOC and its counsel shall have received all such documents and other evidence as they may reasonably request in order to establish the consummation of such transactions and the taking of all corporate proceedings in connection therewith.

(5) BOC shall have received an opinion from Messrs. Shearman & Sterling, counsel for Airco, dated the Closing Date, in form and substance satisfactory to it and to its counsel that the execution, delivery and performance of this Agreement by Airco have been duly authorized and approved by all requisite action of Airco's Board of Directors and stockholders and that this Agreement has been duly executed and delivered by Airco.

C. All obligations of Airco under this Agreement are subject to the condition that, prior to the Closing, Airco's entering into this Agreement shall have been authorized or ratified by Airco's Board of Directors and to the fulfillment at or prior to the Closing on the Closing Date of each of the following conditions, except to the extent that any such condition has been waived in writing by Airco:

(1) All representations and warranties of BOC contained in this Agreement shall be true and correct at the Closing as though such representations and warranties had been made at the Closing.

(2) All covenants and agreements required by this Agreement to be performed and complied with by BOC prior to or at the Closing shall have been duly complied with and performed by BOC.

(3) All corporate and other proceedings to be taken by BOC or BocAir in connection with the transactions contemplated hereby and all documents incident thereto shall be reasonably satisfactory

in form and substance to Airco and its counsel, and Airco and its counsel shall have received all such documents and other evidence as they may reasonably request in order to establish the consummation of such transactions and the taking of all corporate proceedings in connection therewith.

(4) Airco shall have received an opinion from Messrs. Linklaters & Paines, counsel for BOC, dated the Closing Date, in form and substance satisfactory to it and to its counsel that the execution, delivery and performance of this Agreement by BOC have been duly authorized and approved by all requisite action of BOC's Board of Directors and stockholders and that this Agreement has been duly executed and delivered by BOC.

ARTICLE IV

A. Airco agrees that for a period of four (4) years from the date hereof Airco and AIRCO-BOC Cryogenic Plants Corporation ("AirBoc") will purchase from BocAir all their requirements for re-sale or for their own operations of cryogenic plant equipment used in the air separation business (as hereinafter defined), except to the extent Airco or AirBoc satisfies such requirements by their own manufacture, provided that BocAir offers terms therefor (including, without limitation, price on a delivered basis, insurance, freight and duty prepaid, delivery and warranties) at least as favorable to Airco and AirBoc as those offered by any other supplier. Neither Airco nor AirBoc shall have any obligations under this Article with respect to any invitations to bid to which BocAir fails to respond. BOC agrees to cause BocAir to fill all orders placed by Airco with BocAir pursuant to any BocAir bid. For purposes of this Article IV "cryogenic plant equipment used in the air separation business" shall mean prefabricated cold boxes containing the low temperature process equipment and associated piping used in air separation plants unless Airco or AirBoc, as the case may be, elects in any instance to purchase equipment other than distillation columns and/or cryogenic absorption units and have the air separation unit fabricated in the United States of America in which case such terms shall mean

only distillation columns and/or cryogenic absorption units. "Cryogenic Plant Equipment used in the air separation business" shall specifically exclude all machinery items such as pumps and expansion turbines and plant warm-end equipment such as compressors, dryers, silencers, and associated piping and control equipment not operated at cryogenic temperatures. Furthermore, Airco shall have the right to specify or furnish any bought out items such as valves or other process control equipment which may be preferred by Airco or its customer. In cases in which Airco or AirBoc, as the case may be, does not propose to invite bids it shall inform BocAir of the terms offered by any other supplier. In cases in which Airco or AirBoc does invite bids, each of them shall submit its invitations to bid, including specifications and delivery requirements, to BocAir at the same time that they are delivered to all other prospective suppliers. All prospective suppliers, including BocAir, will be required to meet the same deadline for submission of bids. If BocAir submits a bid at least as favourable as that of any other bidder with respect to all the terms and conditions described above it shall be awarded the contract. If not, Airco or AirBoc, as the case may be, will inform BocAir of the terms of the most favourable bid or other offer by telex or telephone and BocAir will have seven (7) days from the date such information is received to meet such bid or other offer and, if it does so, it shall be awarded the contract. Nothing herein shall require Airco or AirBoc to submit to BocAir any process or design know-how or similar technical information received from any third party. The provisions of this Article shall not apply to AirBoc if it shall cease to be a subsidiary of Airco.

ARTICLE V

A. Neither party hereto shall be liable for failure to perform its obligations under this Agreement to the extent that, and so long as, such performance is hindered or prevented by any cause constituting force majeure.

B. Except as may be expressly provided herein all notices and demands which shall or may be given pursuant to this agreement shall be in writing and shall be delivered in person or by prepaid registered

airmail, addressed, if to Airco at:

Joseph Walsh, Esq., Secretary
Air Reduction Company, Incorporated
150 East 42nd Streed
New York, New York 10017

and, if to BOC, at:

Alan Leslie Esq, Secretary
The British Oxygen Company Limited
Hammersmith House,
London W.6., England.

and shall be deemed served on the day on which personally delivered or, if delivered by airmail on the fifth day after being posted, or on the day of actual receipt, whichever is earlier. Either party hereto may change its address for the receipt of notices and demands by notice duly given to the other party pursuant to this Article.

C. Any assignment of this Agreement or any rights hereunder, whether by operation of law or otherwise, by either party hereto without the prior written consent of the other party shall be void.

D. The representations, warranties, covenants and agreements of the parties contained in this Agreement and in the undertaking shall not be discharged or dissolved upon, but shall survive, the Closing on the Closing Date, and shall be unaffected by any investigation made by any party at any time.

E. The invalidity of any particular provision of this Agreement will not affect the other provisions thereof, but this Agreement will be construed to all effects as if such provision had been omitted.

F. The construction, interpretation and enforcement of this Agreement and the undertaking shall be governed by the laws of the United Kingdom.

G. The terms and conditions contained herein constitute the entire agreement between the parties with respect to the subject matter hereof and supersede all previous communications either oral or written between such parties with respect to such subject matter, and no agreement or

CX-49-I

understanding varying or extending any right or obligation hereunder of either party shall be binding unless in a writing signed by a duly authorized officer or representative of the party against which such variance or extension is sought to be enforced.

H. This Agreement shall bind and inure to the benefit of the parties hereto and their respective successors and assigns, but nothing herein shall give, or be construed to give, to any other person, firm or corporation any legal or equitable right, remedy or claim.

I. This Agreement may be executed in one or more counterparts and each of such counterparts shall for all purposes be deemed to be an original but all such counterparts shall together constitute but one and the same instrument.

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed as of the day and year first above written.

Signed by

for and on behalf of
The British Oxygen Company Limited

Signed by

for and on behalf of
Air Reduction Company, Incorporated

A 4154

CX-49-5

Exhibit A

UNDERTAKING

KNOW ALL MEN BY THESE PRESENTS THAT:

WHEREAS, AIR REDUCTION COMPANY, INCORPORATED, a New York Corporation ("AIRCO"), and THE BRITISH OXYGEN COMPANY LIMITED, an English Corporation ("BOC"), are parties to an agreement dated 22nd July 1971 pursuant to which BOC has, as of the date hereof, acquired from AIRCO certain shares of stock of BOC-AIRCO Cryogenic Plant Limited ("BocAir") and BOC has, in connection with such acquisition and for good and valuable consideration, agreed to indemnify and hold harmless AIRCO to the extent hereinafter provided;

NOW, THEREFORE, BOC hereby agrees to indemnify and hold AIRCO and Airco-BOC Cryogenic Plants Corporation ("AirBoc") harmless with respect to any loss, costs, damages, or expenses suffered or incurred by AIRCO or AirBoc as a result of any claim against AIRCO or AirBoc arising prior to or after the date hereof with respect to any obligation of any nature of BocAir or of Airco or AirBoc relating to the business or activities of BocAir prior to October 1st 1971 including except as otherwise expressly provided any such business in which Airco or AirBoc was involved as a supplier to BOCAir or otherwise provided that BOC is given reasonable notice and an opportunity to defend AIRCO or AirBoc against such claim

IN WITNESS WHEREOF, BOC has caused this undertaking to be executed on this first day of October 1971.

THE BRITISH OXYGEN COMPANY LIMITED

By _____

Acknowledged:

AIR REDUCTION COMPANY, INCORPORATED

By _____

Airco-BOC Cryogenic Plants Corporation

By _____

A 4155

CX-49-K

A 4156

CX-50-A

R E S T I C T E D

THE NORTH AMERICAN MARKET
FOR BOC MEDICAL PRODUCTS

THE BASIC ORGANISATIONAL REQUIREMENTS

AN AIDE - MEMOIRE

Circulation
Mr. P. Laister
Mr. A. I. Ray

9th October, 1972
R.J.W.

A 4157

CX-50-B

MR. F. LAISTER
Managing Director

RESTRICTED

The North American Market
for BOC Medical Products -

The Basic Organisational Requirements

Aide Memoire
as a basis for further discussions.

Introduction

As requested I am confirming the points that were raised at our meeting on Thursday last with Mr. Ray.

The Market

In a further report I will be submitting a full analysis of the North American market. My interim conclusion is simple - although BOC's initial entry will be difficult, we can build a substantial profitable business in the United States of America, and we can develop our business in Canada quite considerably. The climate, timing and opportunity has never been better for BOC to make a move to establish a major business entity in the United States. A prime prerequisite is the harnassing of our current human resources in North America (which are very limited in the United States) so that we can blend the talents of the various personalities into a dynamic and constructive management team. My recommendations are outlined below.

Organisational Structure

Supervisory Policy Board

Although I recommend that the day to day management decisions should be dealt with separatively by executives based in Canada and the United States, it is desirable to establish a Main Supervisory Board to take a broad perspective of our future strategies and developements on the North American

Cont[illegible]ent. The structure and composition of the Board could be as follows:-

North American Medical Equipment - Supervisory Board

Chairman	-	Mr. A. Pernam
Managing Director	-	Mr. A. I. Ray
Directors	-	Mr. F. Sweatman
	-	Mr. R. Dow
	-	Mr. [illegible]. J. Williams

I consider that the composition of the Board is strong - it is well balanced vis-a-vis representation from CANOX, the Fraser Sweatman organisation and BOC. It is compact and this should promote good communication and speedy appraisal of alternative policy strategies. I have also considered the personalities and business approach of the individuals and I am satisfied that we will blend full entrepreneurial expertise with that of good, sound, conventional business flair; the broad international approach with that which recognises the essential ingredients needed on a local market plane. The most important fact is that I think it will be acceptable and workable to the people involved.

A 4159

CX-50-D

The Operating Companies

Two operating Companies should be formed:-

1. CANOX MEDICAL LIMITED.
2. AMERICAN MEDICAL EQUIPMENT INCORPORATED.

1. CANOX MEDICAL LIMITED

This Company will be operational from Toronto: will incorporate the present medical activities of Canadian Oxygen and the Fraser Sweatman organisation in Canada. The Company will have a current combined annual sales turnover of in excess of £ 3 million,

1971/72		
£ 2.15	-	Canadian Oxygen
£ 0.85	-	Fraser Sweatman (Canada) Ltd.,

and will be capable of great expansion through deeper penetration of the health care equipment market: administration economies in phase II of integration; acquisitions; new market development (e.g. Deloro Stellite).

The Board of Directors

A new EXECUTIVE Board should be formed to run the Company. It could be constructed as shown below.

Executive Board of Directors

Managing Director	-	Mr. R. Dow
Deputy Managing Director	-	Mr. F. Sweatman
Director	-	Mr. J. Wordsworth
Director	-	Mr. M. Benson

Mr. A. I. Ray and Mr. R. J. Williams could be appointed non-executive directors.

Divisional Structure

If you examine the sales and current markets of the Fraser Sweatman organisation in Canada, see appendices attached, you will conclude that the product strength of the Company lies in the dental relative analgesia field and vaporisers. Conversely, the product strength of Canadian Oxygen is in the hospital equipment/piping/gas markets. My conclusion is that the product ranges are more compatible than competitive. However, we must recognise that if the two organisations seek unilateral development there will be more overlap in the future and I question the desirability of unilateral development in a limited market of 21 million people (with $\frac{2}{3}$ of that market concentrated within the Toronto - Quebec Conurbations).

On the international front we already know that the competition is becoming stronger and they will agressively exploit any BOC organisational, product or service weakness.

My approach to the Canadian market would be as follows:-

Canox Medical Limited

The Company would be divisionalised on the basis of:-

(i) Integrated Product Groupings.
(ii) Market Segmentation.
(iii) Degree of required sales specialisation.

Hospital Equipment Division. - Mr. J. Wordsworth, Executive Director.

This division would market a broadly based range of products to the "total health care system". This would include hospitals, day care centres, group practices, clinics and home care. The product groups would include -

Anaesthesia equipment and accessories.
Inhalational therapy.
Oxygen therapy.
Intensive care (patient monitoring).
Electronic medical equipment.
Rubber/plastic sundries.
Pipeline
Medical gas

(This is not the full list but it gives you a guide to the enormous scope for this division).

CX-50-F

Mr. J. Wordsworth would be the executive director in charge of this division.

Fraser Sweatman Division - Mr. M. Benson, Executive Director

In view of the excellent reputation of Fraser Sweatman I think that it is important to call this division the Fraser Sweatman Division. This division would be basically the current Fraser Sweatman (Canada) Ltd. Company. It would concentrate on the following markets which call for a specialist approach -

(1) Dental Equipment Market.

(2) Orthopaedic equipment market.

(3) Specialist products - mainly vaporisers.

(4) Specialist market situations - for example dealing with original equipment manufacturers and organisations such as Ayerst Laboratories, Abbott Laboratories (see analysis of the ten largest accounts of Fraser Sweatman (Canada) Limited and Fraser Sweatman Incorporated). Please note the current contribution of this specialist business.

(5) We may consider it desirable to keep a Fraser Sweatman brand of anaesthesia machine. This will give Canox Medical Ltd. some flexibility when tendering for large contracts where a marginal price may be required; it could act on occasions as a "competitive block"; distance and sales cost in selected areas of Canada might necessitate a twin marketing approach and in some instances even a twin dealer set up; a customer alternative where Canadian Oxygen entree is currently difficult or vice versa for the Fraser Sweatman product.

Servicing Division

A co-ordinated marketing approach could stimulate increased service revenue and I believe that we could develop a significant servicing division within Canox Medical. In phase I of integration the Fraser Sweatman service department in Toronto would concentrate on servicing the product throughout of the the Fraser Sweatman Division but there is no reason why this department could not be enlarged to give a more broadly based servicing support.

Management Responsibilities.

Mr. R. Dow.

As Managing Director Mr. Dow will be responsible for the total profitable development of Canox Medical Limited in Canada. He will concentrate on ensuring that the resources of the new entity are utilised to the maximum profit of the Company. He will consider the feasibility and desirability of centralising administration, warehousing, accounting and servicing facilities for the new organisation in phase II of the integration of Canadian Oxygen Medical and Fraser Sweatman (Canada) Ltd. In phase I, Mr. Dow will concentrate his line management on the Hospital Equipment Division through Mr. J. Wordsworth, Executive Director responsible for that Division.

Mr. Fraser Sweatman

As Deputy Managing Director, Mr. Sweatman will concentrate on the profitable development of all activities of the Fraser Sweatman Division. He will ensure that distribution is established in Canada for the Deloro Stellite range of orthopaedic equipment and he will seek out and establish a wider base for Canox Medical in the orthopaedic field. Similarly, the dental equipment range will need to be enlarged and Mr. Sweatman will consider the possibility

of making acquisitions in the dental field (in Canada and the United States) which could be exploited in North America and also act as a base for development in other BOC markets. He will play a prominent role in identifying and exploiting areas of innovation for Canox Medical. His experience and entrepreneurial skill is admirably suited to the development of new market and new product opportunities for the Company. CX-50-H

Mr. J. Wordsworth

Mr. M. Benson

Both Mr. Wordsworth and Mr. Benson are capable of carrying out the day to day field work required. I do not anticipate any negative reactions from Mr. Wordsworth or Mr. Benson to these proposals - which incidentally I have not discussed with them except for seeking their views on market development for both organisations.

2. AMERICAN MEDICAL EQUIPMENT INC. CX-5D-I

During my period in the United States, I have formulated views on the strategic alternatives open to us in the world's largest health care market. For the purpose of this "aide-memoire" I am limiting my comments to base conclusions. These are as follows:-

(1) The Market Opportunities

BOC Medical should establish a new company in the United States which will incorporate all current activities and which will act as the framework around which we can build up a substantial business. Long-term (5 years) this market could become our biggest medical equipment market. Apart from the scope this market offers us, it is essential we establish a strong bargaining position in the United States to counter the extra strength our competitors will have in the international markets (Chio, Puritan-Bennett, General Electric for example) if we allow them to expand from a supreme position in their home market.

(2) The Board of Directors

The Executive Board of American Medical Equipment Inc. will implement the strategic policies that will have been formulated by the North American Supervisory Board.

It could be constructed as shown below:

Executive Board of Directors

Managing Director	-	Mr. Fraser Sweatman
Director	-	(Mr. Hal Monsor - Chemetron) +
Director	-	(Mr. D. Kuehn - Chemetron) +
Director	-	Mr. A. I. Ray
Director	-	Mr. R. J. Williams

+ If alternative A is feasible.

A 4165

Cx-50-J

(3) The Alternatives

The two most practical alternatives that we have to establish a significant medical equipment company in the United States are:-

(A) The new Company - American Medical Equipment Inc. would incorporate a joint venture with the medical division of the Chemetron corporation; which would give us a new Company with a current annual sales turnover in excess of $ 20 million.+

+ ((i) Chemetron $ 18 million (including $ 7 million medical gas)

(ii) + Chemetron latest acquisition $ 5 million in dental equipment field

(Chemetron have agreed acquisition price and taken a handshake on the deal. The legal documents have not yet been signed).

(iii) + Fraser & Chatman Incorporated $ 2 million

(v) + or - Harris Lake (equity stake, royalty payment and sales ex Harlow 1971/72 $ 0.25 million approximately)

(B) A "go it alone" venture CX-50-K

It is possible for us to develop a new company in the United States but this will be more difficult than the first alternative. I give below a very brief synopsis of our current resources in the United States.

(i) Management

Fraser Sweatman is a good motivator of people; entrepreneur par excellence; sincere and honest; good technical knowledge of medical products; excellent personal reputation amongst medical profession; first class entree into hospitals; respected by competition and contacts in associated medical companies. Serious succession problem - no visible successor. Mr. Don Rogers - keen, enthusiastic sales manager on a limited scale. I have doubts of his capacity to play a key role in the development of a broadly based national company. If a deal with Chemetron Medical came to fruition, we would have a management framework on which to build. Mr. Kuehn present sales manager of Chemetron Medical could play a more prominent role. If there was no deal with Chemetron, we would have to build a management team to support Fraser Sweatman - an experienced second in command being a prime necessity.

(ii) Product Range

Harris Lake have concentrated solely on the anaesthesia equipment market. They have made reasonable progress on a limited scale. Although Mr. George Lake and Mr. Savage appear to be well respected, their Company is

(B) A "go it alone" venture

CX-50-L

It is possible for us to develop a new company in the United States but this will be more difficult than the first alternative. I give below a very brief synopsis of our current resources in the United States.

(i) Management

Fraser Sweatman is a good motivator of people; entrepreneur par excellence; sincere and honest; good technical knowledge of medical products; excellent personal reputation amongst medical profession; first class entree into hospitals; respected by competition and contacts in associated medical companies. Serious succession problem - no visible successor. Mr. Don Rogers - keen, enthusiastic sales manager on a limited scale. I have doubts of his capacity to play a key role in the development of a broadly based national company. If a deal with Chemetron Medical came to fruition, we would have a management framework on which to build. Mr. Kuehn, present sales manager of Chemetron Medical could play a more prominent role. If there was no deal with Chemetron, we would have to build a management team to support Fraser Sweatman - an experienced second in command being a prime necessity.

(ii) Product Range

Harris Lake have concentrated solely on the anaesthesia equipment market. They have made reasonable progress on a limited scale. Although Mr. George Lake and Mr. Savage appear to be well respected, their Company is

very limited for a total launch into the United States medical equipment market.

CX-50-M

Fraser Sweatman have a narrow product range with the main activity and strength in the dental relative analgesia field and vaporisers/ accessories - please see the analysis of sales attached to this "aide - memoire".

(iii) Sales coverage/Distribution

Both Harris Lake and Fraser Sweatman have limited sales coverage on a national level. Both organisations have a distribution network which although limited, could play an important role in our future distribution arrangements.

(iv) Manufacturing/Assembly facilities

Fraser Sweatman in Buffalo could increase their current capability by moving the office staff to other premises but the premises are limited to support a major national impetus in the medical market.

(v) Research and Development

There exists a small nucleus of skilled personnel that could be used on wider product range activities.

(vi) Warehousing

Both Fraser Sweatman and Harris Lake have limited warehousing facilities.

(vii) Administration/accounting services

Both organisations have limited services on which to build a national organisation of the size I envisage.

A 4169

Over[illegible]nagement

If we pitch our sights at a profitable annual sales volume in excess of £ 20 million per annum in the United States, then Fraser Sweatman Incorporated and Harris- Lake do not "per se" offer a strong basis for expansion.

CX-5D-N

A "Number One Concept"

I believe that we should set our sights on becoming the number one medical equipment company in the United States. In order to do this in the shortest practical time, I envisage the following concept in which we could build a major profitable entity. As you will appreciate we can vary the concept if we are unable to bring to fruition the complete concept:-

(i) Chemetron Medical should be integrated into American Medical Equipment Incorporated with an agreed stake in the equity. Chemetron Medical would have the following advantages:-

(A) Product Range does not conflict with BOC - an analysis I did last Friday with Messrs. Beckwith (BOC) and Kuehn (Chemetron) concluded that the range was more compatible than competitive.

(B) Good distribution on which we could build an even stronger network.

(C) Manufacturing facilities - plenty of room for expansion at their St. Louis production unit.

(D) Regional offices and warehousing.

(E) Nucleus of a management structure.

(F) Medical gases.

(G) Over 50% of USA pipeline business giving us an excellent access for selling secondary equipment.

A 4170 CX-50-0

(ii) Bird Corporation

An approach should be made to sound out Dr. Forest Bird on the possibility of his Company participating in this exciting new venture. Providing he was receptive and the price was acceptable to us, his organisation would add considerable strength, not only in the United States but throughout the world.

American Medical Equipment Incorporated would concentrate initially on the following product areas:-

DIVISION	PRODUCT	DISTRIBUTION
Hospital Equipment	Anaesthesia Equipment	Harris-Lake (HARLAKE brand) could be our brand for selected dealer distribution of anaesthesia equipment.
	Inhalational Therapy	This division would market its products through a new direct sales force and selected medical dealers
	Oxygen Therapy	
	Medical electronics	
	pipeline	
	Accessories (vaporisers. Disposables and non-disposables, regulators, flowmeters etc.)	
	medical gases	
	NEW PRODUCTS	

DIVISION	PRODUCT	DISTRIBUTION
Dental Equipment	Relative Analgesia Equipment	The Fraser Sweatman sales force is a good base for development into this sector of the market
	NEW PRODUCTS (by acquisition)	
Orthopaedics	Deloro Stellite plus an extension of the orthopaedic range	Direct sales force with selected dealers in high direct sales cost areas

Consideration would also be given to establishing an ABHEL equivalent organisation to give a comprehensive service to the American hospitals.

Conclusion.

If we find that there is no possibility of a deal incorporating Chemetron and/or Bird Corporation I still think that we should register the new Company - American Medical Equipment Incorporated. We should then develop with the Supervisory Board of North American Medical Equipment a strategic plan for developing our own resources in the United States. The important point I would like to stress is that time is limited and precious.

R. J. WILLIAMS.

A 4172

CX-50-Q

FRASER SWEATMAN (CANADA) LIMITED

SALES SUMMARY BY PRODUCT CLASS

FOR TEN MONTHS ENDED JULY 31, 1972

	This month	Year to date	
	$	$	%
Sales to Outsiders by Product Class:			
Vaporizers	$30,205	$132,499	19.7
All other accessories	16,082	207,177	30.9
Dental	8,863	242,298	36.1
Veterinary	2,1[illegible]	24,696	3.7
Hospital	2,430	13,090	1.9
Compressed Gas	3,489	33,391	5.0
Monitoring Equipment	39	18,430	2.7
	$63,230	$671,581	100.0
Add: Inter Company Sales:			
Fraser Sweatman Inc.	-	1,906	
	$63,230	$673,487	

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CX-50-R

FRASER SWEATMAN (CANADA) LIMITED

SALES SUMMARY BY CUSTOMER CLASS

FOR TEN MONTHS ENDED JULY 31, 1972

		This month	Year to date	
		$	$	%
(1) Hospital -	Dealer	$ 14,361	$ 69,752	10.4
2)	Direct	11,686	135,536	20.2
(3) Veterinary -	Dealer	3	4,380	.7
(4)	Direct	(261)	22,916	3.4
(5) Dental -	Dealer	2,49	205,453	30.6
(6)	Direct	12,385	117,730	17.5
(7) O.E.M.		14,679	53,765	8.0
(8) Drug Companies		7,879	62,049	9.2
		$ 63,230	$671,581	100.0

FRASER SWEATMAN (CANADA) LIMITED

SCHEDULE OF THE TEN LARGEST ACCOUNTS

FOR TEN MONTHS ENDED JULY 31, 1972

		Net Sales This month	Net Sales Year to Date $	Net Sales Year to Date %	Net Sales Last Year	Variance from Y. T. D. Last Year
1.	Dental Company of Canada	$ 2,220	$ 158,520	23.6	$50,768	$ 107,752
2.	Ayerst Laboratories	8,282	54.063	8.0	76,201	(22,138)
3.	Canadian Oxygen	14 382	53,751	8.0	56,205	(2,45[illegible])
4.	Ohio Medical Products	6,134	26,581	4.0	24,675	1,906
5.	Canada Dental Supply	309	21,390	3.2	43,430	(22,040)
6.	Medi-Dent Service	3,756	18,922	2.8	7,341	11,581
7.	United Dental Supply	24	14,888	2.2	2,903	11,985
8.	Greater Niagara Hospital	-	14,614	2.2	175	14,439
9.	Abbott Laboratories	180	13,853	2.1	22,508	(8,655)
10.	Hospital for Sick Children	35	11,844	1.7	12,959	(1,115)
		$35,302	$ 388,426	57.8		
	All other customers	27,928	283,155	42.2		
		$63,230	$671,581	100.0		

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FRASER SWEATMAN (CANADA) LIMITED

SCHEDULE OF THE TEN LARGEST ACCOUNTS

FOR TEN MONTHS ENDED JULY 31, 1972

		Net Sales This month	Net Sales Year to Date $	Net Sales Year to Date %	Net Sales Last Year	Variance from Y. T. D. Last Year
1.	Dental Company of Canada	$ 2,220	$ 158,520	23.6	$50,768	$ 107,752
2.	Ayerst Laboratories	8,282	54.063	8.0	76,201	([illegible],138)
3.	Canadian Oxygen	14 382	53,751	8.0	56,205	(2,454)
4.	Ohio Medical Products	6,134	26,581	4.0	24,675	1,906
5.	Canada Dental Supply	309	21,390	3.2	43,430	(22,040)
6.	Medi-Dent Service	3,756	18,922	2.8	7,341	11,581
7.	United Dental Supply	24	14,888	2.2	2,903	11,985
8.	Greater Niagara Hospital	-	14,614	2.2	175	14,439
9.	Abbott Laboratories	180	13,853	2.1	22,508	(8,655)
10.	Hospital for Sick Children	35	11,844	1.7	12,959	(1,115)
		$35,302	$ 388,426	57.8		
	All other customers	27,928	283,155	42.2		
		$63,230	$671,581	100.0		

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CX-50-T

FRASER SWEATMAN (CANADA) LIMITED

ANALYSIS OF MAJOR PRODUCT SALES

FOR TEN MONTHS ENDED JULY 31, 1972

	This Month		Year to Date		Budget	Under (Over) Budget
	#	$	#	$	$	$
Fluotec 11	5	$ 1,151	38	$ 9,714		
Fluotec 111	3	764	16	4,005		
Fluotec 111 P.S.	49	12,940	151	41,217		
Pentec 1	2	526	16	3,592		
Pentec 1 P.S.	-	-	5	1,302		
Pentec 11	-	-	4	1,024		
Pentec 11 P.S.	49	13,262	222	60,814		
Cyprane Inhaler	6	389	49	3,423		
Cyprane Inhaler Kits	-	-	-	-		
Draw Over Vaporizer (AE)	2	526	6	1,694		
Stamps	2	250	14	1,725		
Quantiflex R.F.	2	2,430	10	12,327		
Quantiflex R.A.	6	3,170	118	61,614		
Quantiflex M.D.M.	4	2,708	259	127,070		
V.M.S. Machine	2	1,626	21	15,551		
V.M.L. Machine	-	-	3	3,872		
Datascope	-	-	12	15,812		
		$ 39,742		364,756		
Other Products:						
Other Vaporizers		397		4,578		
Major		6,812		71,442		
Minor		8,104		131,707		
Servicing Income:		8,175		99,098		
		$ 63,230		$671,581		

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A 4177

CX-50-V

FRASER SWEATMAN INCORPORATED

SALES SUMMARY BY PRODUCT CLASS

FOR TEN MONTHS ENDED JULY 31, 1972

	This month	Year to date	
	$	$	%
Sales to Outsiders by Product Class:			
Vaporizers	$ 28,688	$ 487,415	31.1
All Other Accessories	51,987	497,783	31.7
Dental	34.581	361,371	23.0
Veterinary	16,383	137,431	8.8
Hospital	3.174	81,784	5.2
Compressed Gas	167	3,452	.2
	$134,980	$1,569,236	100.0
Add: Inter Company Sales:			
F.S. (Canada) Limited	17,737	219,989	
Cyprane Limited	146	4,157	
	$152,863	$1,793,382	

CX-50-W

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FRASER SWEATMAN INCORPORATED

SALES SUMMARY BY CUSTOMER CLASS

FOR TEN MONTHS ENDED JULY 31, 1972

	This month	Year to date	
	$	$	%
(1) Hospital - Dealer	$ 13,407	$162,497	10.3
(2) Direct	29,413	315,240	20.1
(3) Veterinary - Dealer	19.428	161.512	10.3
(4) Direct	1,826	22,568	1.4
(5) Dental - Dealer	41,710	407.159	26.0
(6) Direct	1,170	38,496	2.5
(7) O.E.M.	12,891	189,174	12.1
(8) Drug Companies	14,721	228,283	14.5
(9) Anesthesiologists	324	4,601	.3
(10) Defense Personnel	90	39,706	2.5
	$ 134,980	$1,569,236	100.0

RASER SWEATMAN INCORPORATED

ANALYSIS OF MAJOR PRODUCT SALES

FOR TEN MONTHS ENDED JULY 31, 1972

	This month		Year to date		Budget	Over (Under) Budget
	#	$	#	$	$	$
Fluotec 11	58	$ 11,775	847	$ 171,575		
Fluotec 111	35	6,356	619	131,552		
Fluotec 111 P.S.	12	2,888	128	32,664		
Pentec 1	8	1,635	118	23,339		
Pentec 1 P.S.	1	216	6	1,548		
Pentec 11	9	2,048	165	35,104		
Pentec 11 P.S.	(2)	(228)	100	26,268		
Cyprane Inhaler	2	493	195	12,131		
Cyprane Inhaler Kits	1	99	27	2,805		
Draw Over Vaporizer	1	300	19	4,810		
Sumps	2	250	26	3,055		
A.E. Gas Machine	-	-	-	-		
Quantiflex R.F.	3	1,500	68	54,196		
Quantiflex R.A.	34	11,513	633	214,381		
Quantiflex M.D.M.	48	19,090	266	108,597		
V.M.S. Machine	24	13,560	187	105,931		
V.M.L. Machine	1	840	13	13,555		
		$72,335		$941,521		
Other Products:						
Other Vaporizers		2,856		42,564		
Major		1,574		17,203		
Minor		33,710		303,509		
Servicing Income		24,505		264,449		
		$134,980		$1,569,236		

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CX-50-X

FRASER SWEATMAN INCORPORATED

SCHEDULE OF THE TEN LARGEST ACCOUNTS

FOR TEN MONTHS ENDED JULY 31, 1972

	Net Sales	Net Sales Year to Date		Net Sales Last Year	Variance From YTD Last Year
	$	$	%		
1. Ayerst Laboratories	$ 8,842	$162,279	10.4	$138,305	$23,974
2. Ohio Medical	11,615	90,525	5.8	80,414	10,111
3. Patterson Dental	7,221	56,493	3.6	29,347	27,146
4. Chemetron Corp.	952	43,541	2.8	38,921	4,620
5. D.C.A.S.R. & Defense Personnel	97	39,765	2.5	112,481	(72,716)
6. Abbott Laboratories	5,900	36,753	2.4	79,333	(42,580)
7. Thompson Dental	5,605	32,093	2.0	18,246	13,847
8. Cedesco	2,545	31,701	2.0	-	31,701
9. Holmes Serum Co.	155	30,309	1.9	11,149	19,160
10. Harris-Lake	657	25,874	1.6	17,464	8,410
	$ 43,589	$549,333	35.0		
All other customers	91,391	1,019,903	65.0		
	$ 134,980	$1,569,236	100.0		

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CX-50-Y